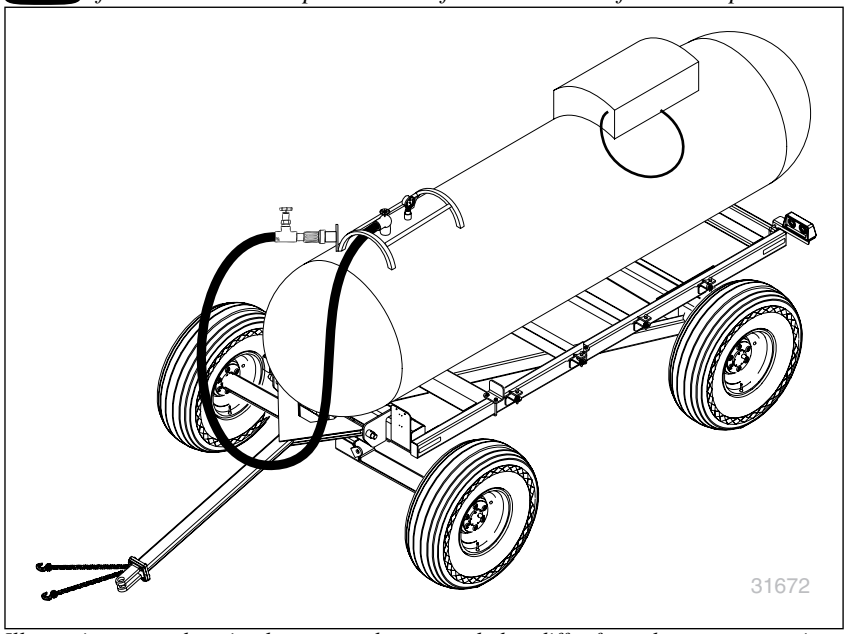
Application Supplement

Nutri-Pro® NH_3 Safety
Using Anhydrous Ammonia Safely

Great Plains
Manufacturing, Inc.
www.greatplainsmfg.com

Read this manual AND the operator's manual entirely. When you see this symbol, the subsequent instructions and warnings are serious - follow without exception. Your life and the lives of others depend on it!



Illustrations may show implements and nurse tank that differ from those you are using.

ORIGINAL INSTRUCTIONS

EN

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Read All Manuals

This **Using Anhydrous Ammonia Safely** manual is a companion manual, supplied with the **Operator** manual for your Great Plains anhydrous applicator.

There are additional manuals covering the metering system, breakaway coupler, flow divider, controller console, and other system components.

This manual, the applicator Operator manual, the meter manual and the breakaway coupler manual are required reading for safe operations. If you do not have the current edition of all manuals, contact Great Plains for replacement copies.

The present manual (407-551M) covers:

- General anhydrous ammonia information.
- Safety information specific to anhydrous ammonia.
- Using anhydrous nurse tanks safely.
- Nurse tank acceptance checklist.

Enhanced Vigilance Required

Although a common, useful, and still economical agricultural fertilizer - liquid or gaseous anhydrous ammonia (NH_3) is an extremely hazardous substance (an EPA EHS hazmat).

DANGER

EPA EHS (Extremely Hazardous Substance):
Despite the common odor, anhydrous ammonia properties are dramatically different from those of household ammonia cleaning solutions (dilute ammonium hydroxide, NH_4OH). An uncontrolled release of NH_3 can easily be fatal or cause permanent disabling injury.

If you are new to NH_3 operations, study everything you can about this chemical and how to use it safely.

Missing Manual Hazard

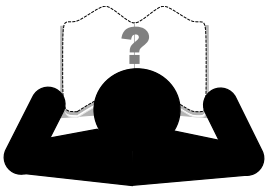
The nurse tank(s) you own or are leasing may not have current manuals. If so, the nurse tank topics in this manual need your attention. These pages cannot be a substitute for a complete and current nurse tank cart manual, but they cover important information for using nurse tanks safely.

Related Manuals, Some for Options

407-502M	Nutri-Pro® NP30A Operator
407-313P	Nutri-Pro® NP30A Parts
407-502M	Nutri-Pro® NP40A Operator
407-313P	Nutri-Pro® NP40A Parts
407-613M	Nutri-Pro® NP3000A Operator
407-613P	Nutri-Pro® NP3000A Parts
417-199M	Nutri-Pro® NP4000A Operator
417-199P	Nutri-Pro® NP4000A Parts
12-M-29	CDS-John Blue IP-1300/1800 Impellicone® parts
016-0159-403	Raven AccuFlow™ Operator manual
016-0159-831	Raven SCS-450 Installation, Operation and Service manual
FVC062	Squibb-Taylor Flo-Max™ manual
016-0159-831	Raven SCS-450 Installation, Operation and Service manual

DANGER

Suffocation, Blinding, Burning, Freezing, Disabling and Disfigurement Hazards:
Your life and health,
the lives and health of your workers and community,
the continued commercial availability of anhydrous ammonia,
*and continuation of agricultural NH_3 transport exceptions depend on you conducting **meticulously careful** operations.*



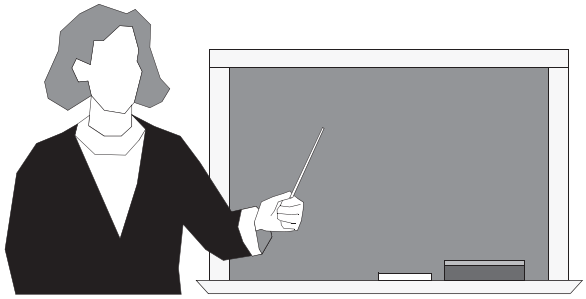
Anhydrous Ammonia Education

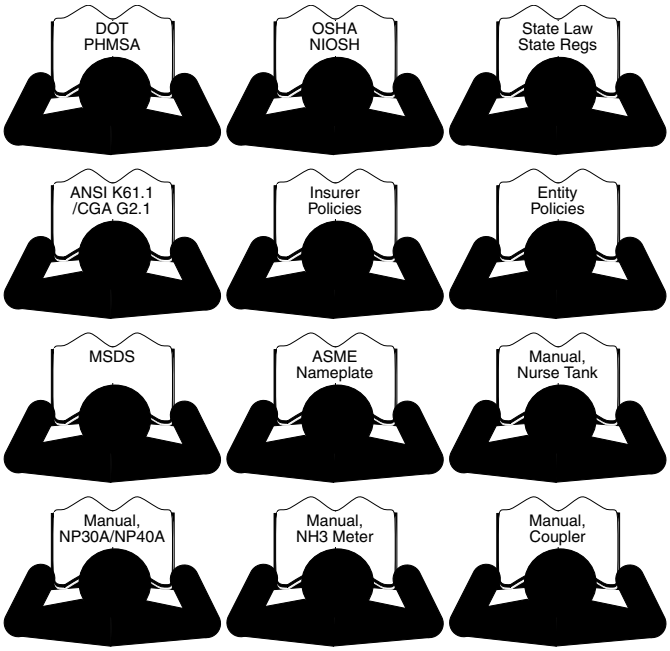
▲ *Read this safety information. It may contain important information not found in your other reference materials.*

▲ *Have anyone operating or merely working near the implement read this safety information.*

▲ *Do not read **only** this safety information.*

▲ *A 20-minute video is no substitute for real anhydrous ammonia safety training.*





Trained, Informed Personnel Only

Anyone working with or near anhydrous ammonia equipment must be fully trained on NH_3 safety, know exact procedures, know regulations, study all safety information provided for materials and equipment, and must be provisioned with adequate personal safety equipment.

This training may be required by law in your locale.

This manual covers important information, *but is not a substitute for training.*

If some terms in this manual are unfamiliar, *do not work with NH_3 until they are.*

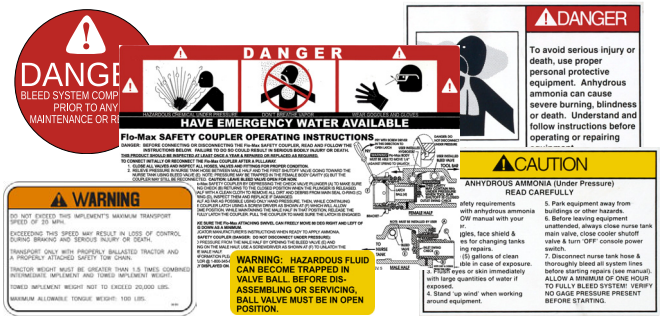
If any topic at right is unfamiliar, assume that the topic applies to your operations, and your personal safety, unless you have researched it and ruled it out.

- This manual is not a substitute for the MSDS and other safety documents provided with the NH_3 itself.
- This manual cannot cover all national, regional and local laws and regulations, nor any organizational or liability carrier rules.
- This manual cannot cover operations for all nurse tanks.
- This manual and the Operator manual do not repeat all of the Raven AccuFlow™ or Squibb-Taylor Flo-Max™ manuals.
- This manual does not repeat full details of the industry standards that apply to anhydrous ammonia tanks and operations.

Study All Decals

Anhydrous ammonia implements and tanks display more decals, more detailed decals, and more ⚠DANGER decals than typical farm equipment.

Have all operators inspect all decals before using the equipment. Make sure all operators understand what hazards the decals identify, what the correct operational procedures are, and what emergency actions to take.



Be Aware of Signal Words

Signal words designate a degree or level of hazard seriousness.

DANGER indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury. This signal word is limited to the most extreme situations, typically for machine components that, for functional purposes, cannot be guarded.

WARNING indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury, and includes hazards that are exposed when guards are removed. It may also be used to alert against unsafe practices.

CAUTION indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury. It may also be used to alert against unsafe practices.

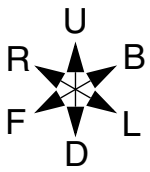
Definitions

The following additional terms are used throughout this manual.

NOTICE indicates a crucial point of information related to the preceding topic. Read and follow the directions to remain safe, avoid serious damage to equipment and ensure desired field results.

Note: Useful information related to the preceding topic.

Right-hand and left-hand as used in this manual are determined by facing the direction the machine will travel while in use unless otherwise stated. An orientation rose in some line art illustrations shows the directions of: Up, Back, Left, Down, Front, Right.



A consistent system of callouts is used for most implement and nurse tank cart components. See page 42 for an applicator system illustration.

A11 3-character callouts in the range A11 to A49 refer to Nutri-Pro® NH_3 system components (page 42).

A51 3-character callouts in the range A51 to A87 refer to nurse tank cart components (pages 10 to 22).

Prepare for Emergencies

▲ *Keep emergency numbers for doctor, ambulance, hospital and fire department near phone. Know the reporting requirement for spills or releases of the chemicals you are using. Have contact numbers available.*

▲ *For anhydrous ammonia operations, have additional contact information for:*
- *national response center*
- *regional (state) response center*
- *local response center*

▲ *Have a first aid kit for typical farm injuries, but ignore it for anhydrous ammonia exposure.* ***The only first aid for anhydrous ammonia is water.***

Anhydrous Ammonia Information

NH_3 Icons and Decals

Topics in this manual, and the Operator manual, that concern anhydrous ammonia safety are shown with these icons nearby.

NFPA 704 3-1-0 hazmat diamond:
(see page 5 for details) This information is for emergency responders, and is typically displayed only at fixed anhydrous ammonia facilities (terminals), and not on nurse tanks or implements.

DOT UN 1005 Class 2.2 hazmat placard:
This information is for trained users of the material and emergency responders. This decal identifies:

- Green Color non-flammable (but see "2")
- Tank Icon content is a gas (at ambient temperature and atmospheric pressure - in the tank, it may be a liquid)
- 1005 Material Identity: Anhydrous Ammonia
- 2 Hazmat Class: Division 2.2: a non-flammable gas that can ignite under some circumstances

ANHYDROUS AMMONIA INHALATION HAZARD:
This decal is for all users and the general public.

General NH_3 Information

Fertilizer Type: 82-0-0
Chemical formula: NH_3
CAS number: 7664-41-7
EC NUMBER (EINECS): 231-635-3
EC INDEX NUMBER: 007-001-00-5

NH_3 is a colorless gas at room temperature (any clouds observed in releases are usually water or ice condensed from the air by the refrigerant effect of NH_3 evaporation).

NH_3 is a colorless liquid, and is only a liquid at room temperature if chilled and/or under pressure.

NH_3 gas has a distinctive odor that provides warning of dangerous concentrations (unless you have impaired sense of smell, or develop olfactory fatigue/adaptation due to extended low-level exposure).

Safe field operations can keep exposures below permissible limits. Unsafe operations, accidents and malfunctions can result in exposures at ANY concentration.

NH_3 Concentrations (Parts Per Million)

5 ppm	Odor detection threshold (most people)
20-50 ppm	Readily detectable odor
25 ppm	NIOSH TWA (Time Weighted Average) exposure limit
35 ppm	NIOSH STEL (Short Term Exposure Limit)
50 ppm	OSHA PEL (Permissible Exposure Limit, 8 hour TWA)
100 ppm	Rapid eye and nose irritation
150-200 ppm	General discomfort, eye tearing. No permanent health effects on short exposure
200 ppm	AIHA ERPG-2 one-hour exposure limit
300 ppm	OSHA IDLH (Immediately Dangerous to Life and Health).
400-700 ppm	Severe irritation of eyes, ears, nose and throat.
1700 ppm	Coughing, bronchial spasms
2000-3000 ppm	Dangerous: could be fatal in less than 30 minutes
5000-10000 ppm	Rapidly fatal - escape may be impossible.

Why Anhydrous Ammonia (NH_3) Differs…

…from typical liquid fertilizers:

▲ ***NH_3 is intensely hygroscopic:***

On contact with water, such as unprotected skin, eyes, mouth, airway and lungs, it dissolves immediately, desiccating the cells and forming ammonium hydroxide.

▲ ***NH_3 is highly caustic:***

Ammonium hydroxide formed on contact is a strongly corrosive alkaline solution, resulting in severe chemical burning of skin and mucous membranes.

▲ ***NH_3 is volatile:***

NH_3 boils at -28 °F (-33.4 °C), expanding by over 850 times. It remains liquid in the nurse tank only because it is pressurized at up to 250 psi. Leaks or above-ground releases immediately cause an expanding gas cloud. Tanks begin venting above 116 °F (46.7 °C).

▲ ***NH_3 has a high heat of vaporization:***

NH_3 is a powerful refrigerant. Evaporating (boiling) liquid NH_3 may be at -100 °F (-73 °C), freezing whatever water it touches (in addition to the other hazards). This can freeze clothing to skin, prolonging tissue damage.

▲ ***NH_3 is combustible:***

Although NH_3 generally does not burn with a self-sustaining flame in the field, it is a significant fire hazard in closed areas and/or if released near hot ignition sources (such as during welding on implements).

▲ ***NH_3 is reactive:***

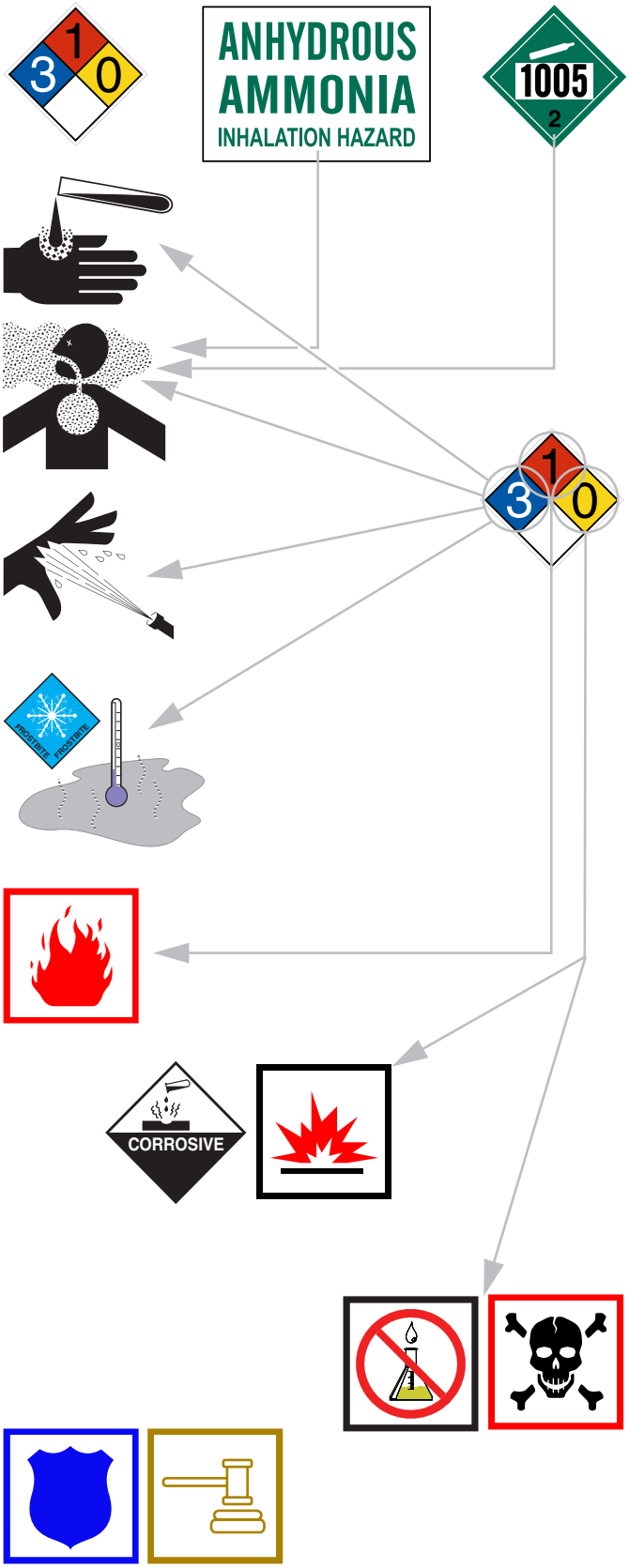
Although the reactivity is classified as "0" (in the NFPA 3-1-0 diamond for emergency response purposes), NH_3 does react with various materials, and can produce hazardous by-products and/or have hazardous side-effects.

NH_3 is corrosive to a surprising number of metals (see page 35). Repairs with incompatible parts are likely to result in malfunctions and a serious accident. Brass parts in particular can fail rapidly, from the inside out.

Mixing NH_3 with some common household and agricultural chemicals can, for example, produce highly toxic gas. Never mix NH_3 with acids.

▲ ***NH_3 is attractive to criminals:***

Do not leave a loaded tank unattended. Secure your tank. Clandestine lab operators steal NH_3 from unattended nurse tanks. Criminals and vandals often leave a tank in an unsafe state.

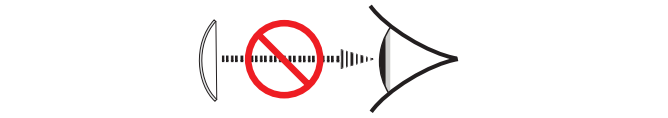


Personal Safety with Ammonia

▲ *Carry personal flush water and wear Personal Protective Equipment (PPE) at all times when working with or near the nurse tank, and when working with an applicator not known to be completely purged. Minimum PPE is:*

- Carry a sealed squeeze container with 8-10 fluid ounces (270 ml) of clean water or saline solution.
- Wear non-vented chemical splash goggles specified for use with anhydrous ammonia. If you wear glasses, make sure the goggles seal completely. A vented full face mask provides extra splash protection, but is not a substitute for primary ***non-vented*** eye protection.
- Wear long cuff chemical gloves specified for use with anhydrous ammonia. Turn back the cuff ends to catch any liquids when arms are raised.
- Wear clothing made of heavy, tightly woven fabric, that can be closed at the neck, and at the cuffs of long shirt sleeves and long pants. Wear boots or high, closed shoes.
- Have a mirror for inspecting ends of fittings, ports and hoses. Never point an NH_3 source at your face.
- Great Plains strongly recommends carrying a wireless telephone or 2-way radio.

▲ *Do not wear **contact lenses** when working with/near anhydrous ammonia, nor with equipment that may contain residual NH_3 liquid/gas. NH_3 can cause permanent eye damage faster than you can remove contacts for eye washing.*



▲ *Unfrozen wash water is required. Completely replace water daily or more often in the 5 gallon (19 liter) tanks on nurse tank cart and on implement. Wash water tanks may be vented to allow the water out at the tap. The vent allows NH_3 gas to enter and gradually form an ammonia solution.*

▲ *Respirator?*
Full face piece respirator protection is required for workers at fixed ammonia facilities, but not for field operations. Should you choose to use a full face respirator when operating the applicator, be aware of two risk factors:

1. Loss of Warning: Filter cartridges may reduce ammonia odor, preventing detection of malfunctions or dangerous fume concentrations.
2. Over-Confidence: Typical respirators are intended for extended *low-level* exposure, or *escape* from high levels. They do not provide extended protection at or above IDLH[a] (300 ppm).

a. A vapor concentration Immediately Dangerous to Life or Health

Ammonia Emergency Action

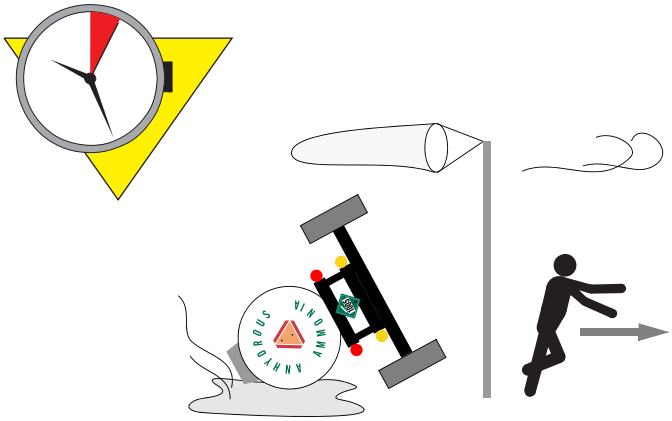
▲ ***Have a plan.*** *Execute the plan.*
Expect the possibility of exposure or uncontrolled release in any phase of setup, transport or operations. Have contact information at hand. ***Know the wind direction at all times****.*

▲ ***Act Quickly:***
Training matters.
You must know what to do, and act without hesitation.

▲ ***Move or Turn Up-Wind:***
The first priority is to avoid exposure, or stop further exposure. On splash or spill, get out of the vapor cloud. Move up-wind.

If a leak is detected while operating in the field, turn the tractor into the wind, lower the implement into the ground and perform an emergency flow shut-off. Pull the rope.

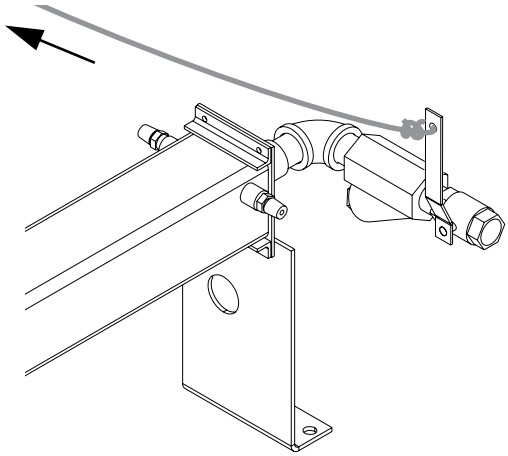
If a breakaway occurred, move the tractor some distance upwind from the disconnected nurse tank.



▲ ***Apply First Aid:***
Treat exposures with water flushing (and only water or saline solution, unless instructed otherwise by a physician). Irrigate continuously. Get professional medical help as soon as possible.

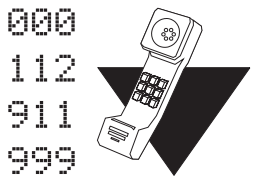
Do not stop with one flush. Apply water until a physician takes over or instructs otherwise. In particular, do not use lotions, ointments, salves or creams. They can trap the harmful agents under the skin.

▲ ***Close Valves Only if Not in Vapor Cloud***
Once clear of the cloud, evaluate if it is safe to close any shut-off valves not already closed.
DO NOT re-enter vapor cloud.
DO NOT attempt leak/spill control other than valve closure.
If Raven SCS 450 console is on, set MASTER switch off.
Do not turn POWER switch off.



▲ ***Escape:***
Continue moving upwind of any uncontrolled release. The wind may shift. On a calm day the ammonia cloud expands in all directions.

▲ ***Notify:***
Summon any aid required. Notify local authorities of any uncontrolled release. Protect the public. Protect livestock if that can be done without further exposure.



▲ ***Stay in Contact:***
Be available to responders with whatever information they require. Do not attempt to correct the accident problem yourself. Standard field PPE[a] safety equipment is suitable only for normal operations and escape. Field PPE[a] is not safe for emergency response.

a. PPE: Personal Protective Equipment

Ammonia Nurse Tanks

Use nurse tanks with proper current safety certification, and current safety equipment and features.

Consult with your anhydrous ammonia supplier for safety information and correct safe handling, transport and use of anhydrous ammonia.

Consult with local and regional authorities on Safe and legal use of anhydrous ammonia, including emergency and environmental contacts, and release reporting requirements.

Review any decals and manuals available for your nurse tank cart, and for any of its components. There may be separate manuals for the tank, running gear, indicators, valves and fittings.

This manual covers typical operations for a representative NH_3 nurse tank cart. Compare the features and controls of your cart to the model cart, so that there will be no confusion about instruction steps.

CAUTION

Control Variation Hazard:
If you are using multiple nurse tanks, study each one separately. Unless they are owned by you, and known to be identical, there is a high probability that there are differences between them, even if they are all from the same terminal.

NOTICE

Trailing Nurse Tanks Only:
This manual, and the applicator Operator manual, do not cover operations with "applicator" anhydrous tanks.

A consistent system of callouts is used for most nurse tank cart components.

(A51) 3-character callouts in the range (A51) to (A87) refer to nurse tank cart components, decribed on page 10 through page 22.

Nurse Tank Security

NOTICE

Standard Tank Controls:
This manual, and the applicator Operator manual, assume standard (unlocked) tank fittings and controls are in use.

Figure 1 31558
Typical NH_3 Terminal

CAUTION

Missing Information Hazard:
Take action to inform yourself. The majority of anhydrous ammonia nurse tanks do not have an operator manual, for the complete cart or for just the tank. Any manual that is available may not accurately document the cart at hand, due to expired component replacement, and/or complete tank replacement.

NOTICE

Field Operations Only:
This manual, and the applicator Operator manual, cover only nurse tank field operations. Nurse tank terminal operations, transport, storage and detailed maintenance are beyond the scope of this manual.

Nurse Tank Safety

Many nurse tanks in use today were originally assembled by cart integrators who are no longer in that business, or assembled by an implement dealer, or by an end user.

Cart running gear often remains in service for decades, with a periodic tank replacement, at which time it is essentially a completely different nurse tank cart.

Hoses and various fittings are limited-life components that are routinely replaced, and the replacements may not precisely match the original parts.

In as few as four years, any original cart documentation may no longer accurately describe the cart in its current configuration.

If you do not have a current, up-to-date operator manual for the nurse tank cart, study the "**Ammonia Nurse Tanks**" section of this manual, starting on page 8.

⚠ CAUTION

Missing Information Hazard:
Many nurse tanks have no operator manual.
They may not have even a tank operator manual.
*If there is a manual, the cart may have been modified, or the tank replaced. Fittings are routinely replaced. Study how the nurse tank works. The tank configuration, fitting, hoses, indicators and controls may vary from the original documentation (if any), and vary from the typical tank described in the section "**Ammonia Nurse Tanks**" on page 8.*

- ▲ *Do not fill, accept or use a tank unless it conforms to current regulatory and safety requirements, and passes a careful inspection. Print pages 23 and 24 to use as checklists. If the answer to any of the items is "no", do not use the tank.*
- ▲ *Pull-type two-axle tanks only (no semi-mounted nurse tank carts).*
- ▲ *Maximum total capacity 3000 gallons.*
- ▲ *Never fill to more than 85% capacity.*
- ▲ *Never transport a nurse tank behind an implement on public roads.*
- ▲ *Never park a tank on public roads or in populated areas.*
- ▲ *Transport slowly: 20 mph (32 kph) maximum*
- ▲ *Never leave a loaded NH_3 tank unattended. Never leave a nurse tank unsecured.*
- ▲ *Know and follow the law applicable to anhydrous ammonia tanks, transfer, transport and application. Some jurisdictions require permits and specific documents and equipment configuration for highway transport.*
- ▲ *Know how to perform a basic safety inspection of a nurse tank (page 23). Do not fill or accept or fill a tank that fails inspection.*

Example: Peeling and Missing Safety and Informational Decals

Example: Illegible or Missing Name Plate

Example: Failing or Outdated Hose

Nurse Tank Cart Components

For use with a Nutri-Pro® applicator, the nurse tank must be a full-trailering pull-type with two or more axle running gear. The Nutri-Pro® is not designed to pull a semi-mounted tank.

Note: Callout numbers A51 through A87 identify the same nurse tank components throughout this manual and the applicator Operator manual.

Cart Hitch

Refer to Figure 2

A51 A Nutri-Pro® applicator requires a nurse tank with a clevis hitch having a locking 1 inch (2.5 cm) pin. See the applicator Operator manual for cart hitching and page 31 for unhitching.

A52 At least one safety chain is required. In some regions, regulations may already require two safety chains. Each chain, clasp, and weld must be rated for the gross weight of the loaded cart.

A53 The tongue may have supports or caddies for hose management (the depicted cart has the Acme parking plug on top). Make sure you understand the purpose of any tongue features.

When the nurse tank hose is attached, check that the forward point at which it is secured to the tongue or cart frame is at least 3 feet (92 cm) from the implement break-away, with enough slack to elevate the hose at least 13 inches (33 cm) above the implement breakaway.

Note: Nutri-Pro® implements do not provide a lighting harness at the rear hitch, as field operations do not require nurse tank lights. If the nurse tank has lights, make sure there is provision to secure that harness during field operations.

Note: A Nutri-Pro® implement does not provide pass-through connections for air, hydraulic or electric brakes, as field operations do not require brakes. If the nurse tank has brakes (rare), make sure they can be set to off (freewheeling), and there is provision to secure the unconnected brake lines during field operations.

A54 Nurse tank cart tongues typically have unlimited vertical movement. If the tongue pivots have stops, make sure the clevis can be elevated to at least 48 inches (122 cm) above ground (for implement lift in field turns).

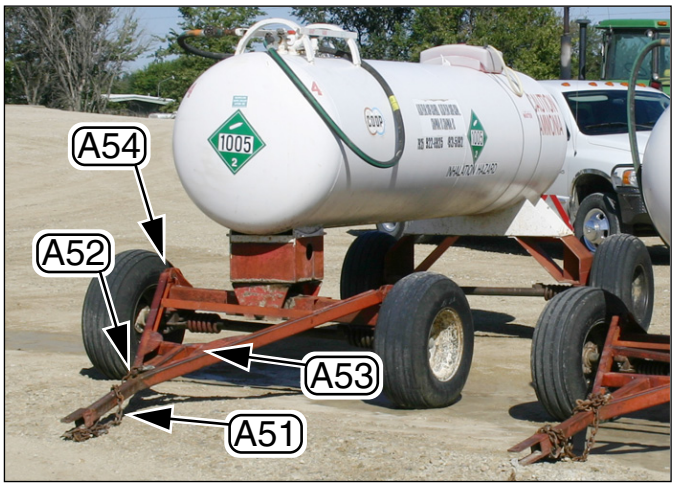


Figure 2 31559
Nurse Tank Hitch

Nurse Tank Front End

A cart may have one or two tanks. A two-tank cart often has a separate hookup for each tank. A two-tank, two-hose cart may be used with a dual-cooler implement, or a single-meter implement (one tank after another).

Refer to Figure 3

A55 UN1005 decal:
See page 4. This information is for trained users of the material and emergency responders.

A56 25 MPH mirror image decal:
This decal is for the benefit of the operator transporting the cart on public roads. It reads legibly in a rear view mirror.

A57 Acme[a] parking plug:
An acceptable nurse tank must have a means of securing the outlet end of each hose. This is usually an Acme-threaded plug mounted on the tank or tongue. See the applicator Operator manual for hose hookup and unhitching.

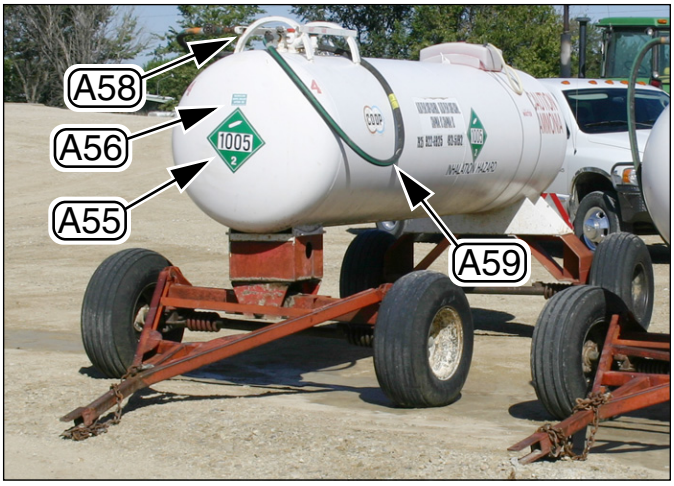


Figure 3 31559
Nurse Tank Front

CAUTION

Vapor Exposure Hazard:
Acme plugs typically do not have gaskets, and do not make a gas-tight seal. Residual liquid or gas in the hose slowly vents at the plug. Use valves to close lines.

Refer to Figure 4

A58 Acme Female Hose Coupler:

On a leased tank, the terminal may supply no hose, in which case you need to provide your own.

This end of the hose connects the tank withdrawal valve to the leading implement inlet at the breakaway coupler. For use with a Nutri-Pro® applicator, the outlet end of the hose must be equipped with a $1\frac{3}{4}$-4 female Acme fitting.

The outlet end of the hose has a swivel collar[b] or shroud containing the female Acme fitting. This allows connection without needing to twist the hose.

Acme hose couplers are intended for hand tightening only. Do not use tools to make the cart-implement connection. A liquid-tight seal is made by the gasket in the male Acme fitting on the implement break-away coupler.

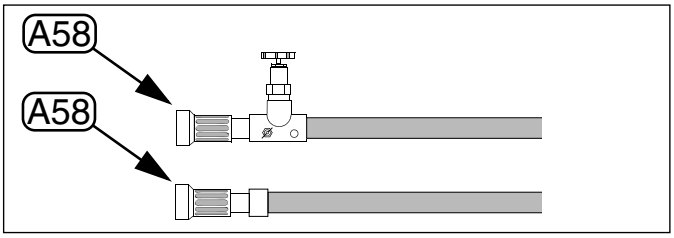


Figure 4 31567
Acme Hose Coupler

CAUTION

Suffocation, Blinding and Burning Hazards:
Never disconnect at an Acme coupler without first:
- *shutting off the line at all valves, and*
- *bleeding the line at the connection.*

Be up-wind for all operations.

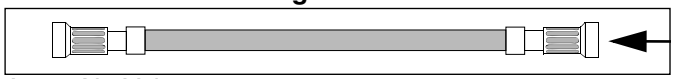
a. Acme refers to the ANSI/ASME B1.5-1997 screw thread, which has a coarse trapezoidal thread profile.
b. Acme collars may be aluminum, but all internal coupler components must be NH_3-safe, typically stainless steel.

A59 Outlet Hose:

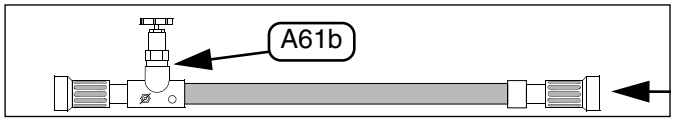
The hose itself and any crimped or swaged NPT[a] fittings are limited-life components. Check the remove-after date on the hose. Valves and other fittings may also be limited life.

Valves are described on page 13. Hoses may be supplied in any of several valve configurations. See table at right. Flow turn-on and turn-off sequencing is different for each hose configuration. See "**Starting NH_3 Tank Flow**" in the applicator Operator manual and "**Stopping Application**" on page 29.

A59. **Outlet Hose Configurations**

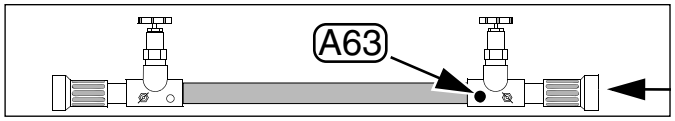


A59a. No Valves



A59b. Valve at Outlet End

A59c. Valve at Inlet End



A59d. Valve at Both Ends

Figure 5 31567
Nurse Tank Hose Configurations

Refer to Figure 6

A60 Nurse Tank Hose Body:

Hose data is printed on the full length of the hose. The key information for operators is that the hose is designed for "ANHYDROUS AMMONIA" use, and that the replace-by "REMOVE ... BEFORE" date has not yet arrived.

Do not rely exclusively on the expiration date. Inspect the hose for excess wear, damage and other signs of imminent failure. See hose checklist on page 23.

Figure 6 31535
Hose Data Stripe

a. National Pipe Thread (tapered). Never disconnect anhydrous ammonia NPT fittings in routine use.

Refer to Figure 7

A61 Hose Valve(s)

If the nurse tank hose has one or more valves, study how they work.

Hose valves are typically hand wheel valves (as shown (A61b)), or lever valves. Read any documents provided for the valves. Have the terminal or dealer explain how the valves work.

WARNING

Suffocation, Blinding and Burning Hazards:
Never test an anhydrous ammonia hose valve unless you are absolutely certain the hose and valve bodies are empty, or both hose ends are securely connected to sealed systems.

▲ ***A two-valve hose can contain a substantial amount of NH_3 even when completely disconnected. See "Avoid Line Traps" on page 37.***

▲ *Older ball valves can contain NH_3 inside the ball when closed, even though disconnected at both ends. See "**Avoid Ball Traps**" on page 38.*

Follow instructions for bleeding and checking. Never use a valve handle as a carrying handle. Keep hands clear of bleed valves when carrying a hose.

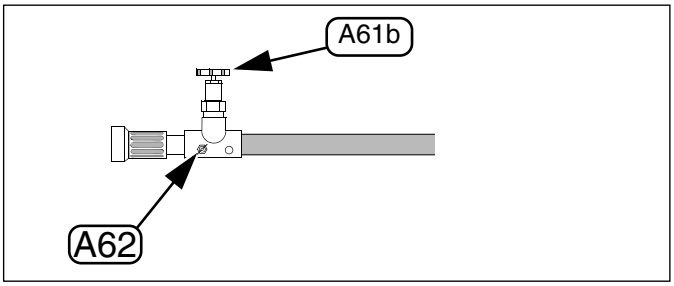


Figure 7 31535
Hose Shut-Off and Bleed Valves

Refer to Figure 8

A62 Bleed Valve(s):

Hose valves typically have bleed valves. The purpose of a bleed valve is to perform a controlled release, via an orifice (A62a), of any fluid or gas trapped in the *closed line* prior to disconnect at a nearby Acme fitting.

A single bleed valve may be located on the inlet or outlet side of the valve, and only protects that side of the circuit when the valve is closed. More rarely, a shut-off valve has bleed valves on both sides of the valve.

Study the location of all bleed valves on your nurse tank and implement.

CAUTION

Suffocation, Blinding and Burning Hazards:
Be up-wind when operating a bleed valve.
Wear chemical gloves when operating a bleed valve.
Wear goggles when operating a bleed valve.
Do not place your body or head in front of the orifice.
Follow a check-list when operating a bleed valve.
Open a bleed valve slowly.

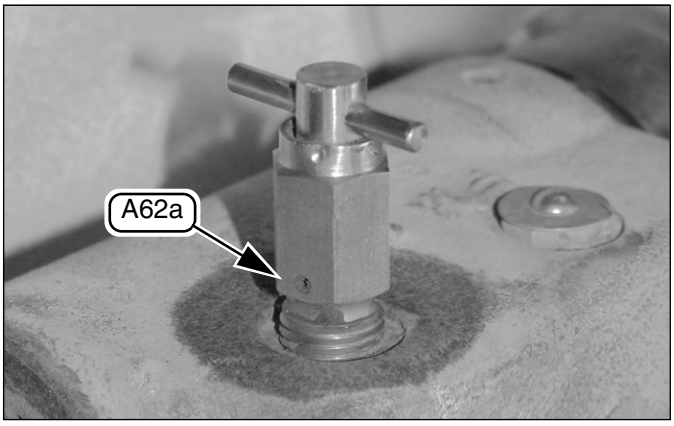


Figure 8 31569
Bleed Valve ▢ Detail

Refer to Figure 9 (depicting a hydrostatic relief valve, with a bleed valve for scale)

A63 Hydrostatic Relief Valve:

Hydrostatic relief valves may be found at multiple locations, typically anywhere that NH_3 could be trapped (such as in a dual-valve hose).

These are usually identified by a black polymer cap. If the cap is missing, the valve may have been activated at some time.

Hydrostatic relief valves are designed to open at pressures higher than the nurse tank pressure relief valve (A80) (page 18, 250-265 psi). Normal excess pressure vents at the nurse tank pressure relief valve. A release at a hydrostatic relief valve indicates a malfunction or operator error.

Hydrostatic relief valves are usually limited-life components.

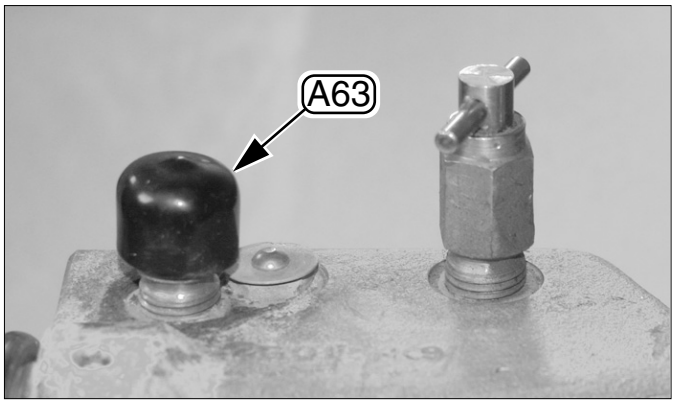


Figure 9 31564
Hydrostatic Relief Valve

Nurse Tank Forward Fittings

Refer to Figure 10 and Figure 11

A welded roll cage, normally located at the top front of the tank, contains all the operating and status fittings except the relief valve (A80, page 21), and the drain valve (A79, page 21).

Decals on the tank or protective structure may identify the valves and fittings. Valves may be color-coded. Make sure all operators know where each valve or fitting is located. Several of the valves have a similar mechanical appearance.

As the tank operator, you will operate one of these fittings (the withdrawal valve A66), and periodically check two others (the pressure A68 and float A71 gauges).

You need to know the functions of all of the fittings in this group for purposes of tank inspection and acceptance.

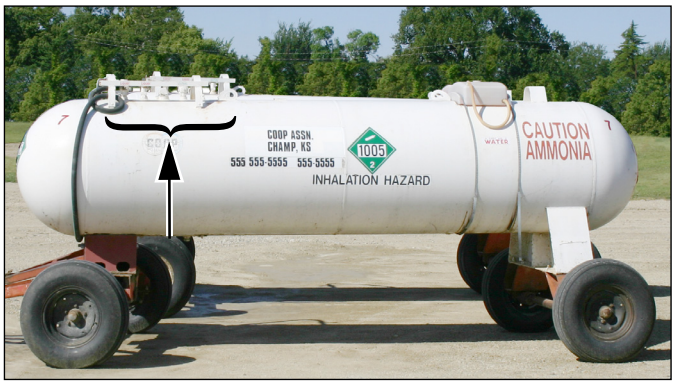


Figure 10 31560
Nurse Tank Forward Fittings

Refer to Figure 11 (some components shown exploded for clarity - never remove any except the outlet cap).

A64 Outlet:
The inlet end of the nurse tank hose attaches to this fitting, which is located at the withdrawal valve (A66) (which itself may not be on the tank top. See page 16).

This may be a male Acme fitting, and if so should have a an Acme cap on it when the hose is disconnected. This Acme fitting may be a different size than the implement $1\frac{3}{4}$-4 fitting, and if so, will only accept one end of the hose.

If the hose connects with an NPT fitting, it is not intended for routine disconnection.

A65 Excess Flow Valve:
This (usually time-dated) fitting may not be present, or may be internal to the withdrawal valve (A66). Its function is to substantially obstruct flow if an unusually high flow is detected, such as a complete shearing of the hose or a major breach in the hose.

If present, and correctly specified for the hose size and maximum application rate, field operators do not normally[a] interact with this fitting.

Ammonia Release Hazard:
Do not approach a breached hose. In the event of a hose breach, an excess flow valve does not completely shut off NH_3 flow. It reduces flow, which may still be a substantial fraction of a gallon per minute. This flow may or may not be marked by a visible cloud. ***This flow rate is beyond the capabilities of field PPE***[b]*. Summon emergency responders.*

Note: An excess flow valve may also be present at the liquid filler valve (A67) or the vapor valve (A70).

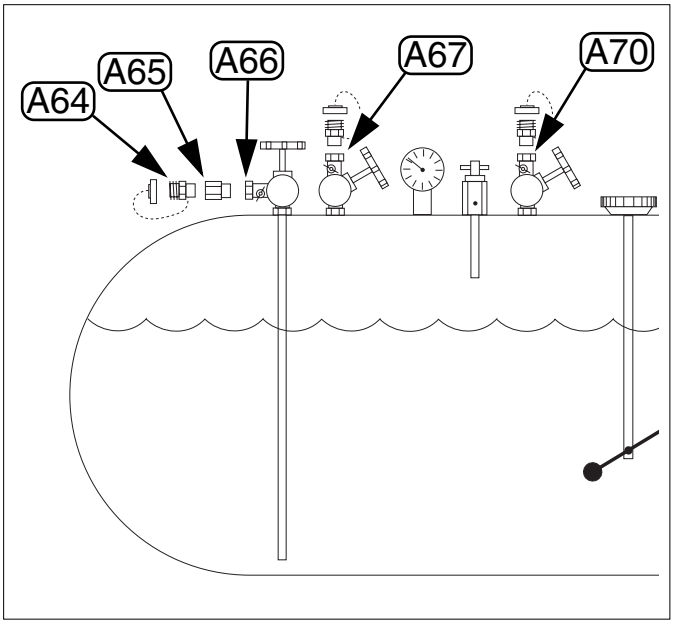


Figure 11
Nurse Tank Outlet Fittings
31574

a. It is worthwhile to learn if an excess flow valve is installed, how to know if it has engaged, and what the reset procedure is. Also, an incorrect configuration of undersize I.D. fittings on the outlet side of an excess flow valve could result in the valve failing to operate in the event of a breach. If any reducer bushing or fitting present, reconsider accepting the nurse tank.
b. PPE: Personal Protective Equipment

Refer to Figure 12 (some components shown exploded for clarity - never remove any except the outlet cap).

A66 Withdrawal Valve:

In field operations, this valve is
opened first, and
closed first.

CAUTION

Ammonia Release Hazard:
Never open the withdrawal valve unless:
a. all other valves and bleed valves, are closed, or;
b. the implement is configured and ready for use.
Always be on the up-wind side for valve operation.
Always open slowly.
Always check for signs of release when opening this valve.

The withdrawal valve is the application outlet valve. It is usually located on the tank top, but may be located on the bottom. It is color coded red or orange.

The withdrawal valve may have an integrated bleed valve or relief valve. Keep all bleed valves closed except during disconnections. Be aware of relief valves and stay up-wind of them.

A top-mount valve has a "dip tube" (A66a) which collects the liquid NH_3. Note that there is no pump. Application flow is driven by:
a. vapor pressure of the NH_3 gas above, and
b. gravity siphoning due to tank elevation.

In cold weather, vapor pressure may be insufficient to support high application rates. See page 25 for further information on cold weather operations.

As there must be a gap between the dip tube inlet opening and the tank bottom, there will be some amount of ammonia that cannot be withdrawn as liquid. This is normal and also provides safety. The residual liquid ensures that the tank contains only NH_3, under positive pressure.

DANGER

Explosion Hazard:
*Stop application when the flow meter and cooler pressure gauges indicate that the liquid level in the nurse tank has reached the dip tube inlet. Leave the residual NH_3 in the tank. Attempts to apply **all** of the liquid NH_3 could cause air to be introduced to the tank, creating a potentially combustible mixture.*

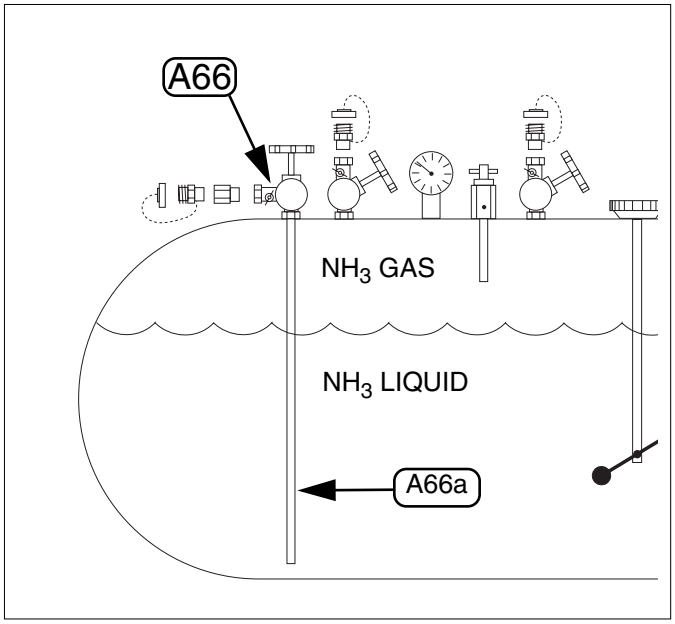


Figure 12
Nurse Tank Withdrawal Valve
31574

Refer to Figure 13 (some components shown exploded for clarity - never remove any except the outlet cap).

A67 Liquid Filler Valve:

Do not open this valve. Field operators need only confirm: valve closed, in sound mechanical condition, and Acme cap secure.

This valve, color coded red or orange, is used only during tank fill at a terminal.

A68 Pressure Gauge:

This gauge reports the pressure (usually in psi) of the NH_3 gas at the top of the tank. The reading varies with tank and ammonia temperature.

A freshly filled tank reads between 50 and 250 psi (at air temperatures above freezing). Learn the relationship between temperature and vapor pressure. Do not accept a tank with a malfunctioning gauge.

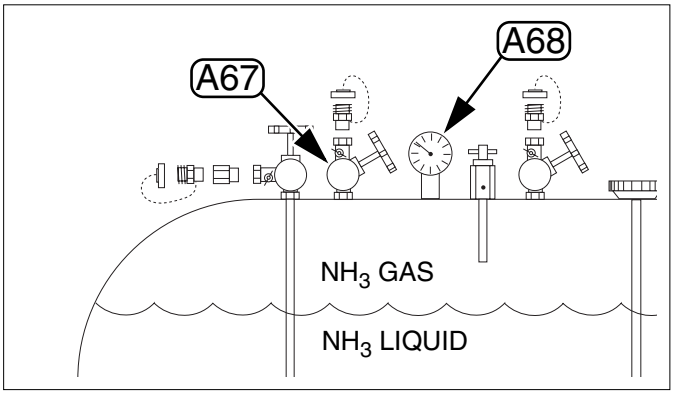


Figure 13 31574
Filler Valve and Pressure Gauge

CAUTION

Ammonia Release Hazard:
At 120°F (40°C), the vapor pressure reaches 250 psi. Above this point, the relief valve (▢ on page 21) periodically operates, and small NH_3 releases occur.

Refer to Figure 14 (some components shown exploded for clarity - never remove any except the outlet cap).

A69 Fixed Liquid Level Gauge:

Do not open this valve. Field operators need only confirm that the valve at this fitting is closed and is in sound mechanical condition.

This gauge is a short dip tube, with its lower end at the 85% fill level in the tank. During filling, if terminal personnel have any doubt about the reading on the float gauge (A71), they may open the fixed gauge and see if what is released is gas or liquid. *This is a hazardous operation requiring terminal PPE*[a].

A70 Vapor Valve:

Do not open this valve. Field operators need only confirm that this valve is closed, is in sound mechanical condition, and that the Acme cap is secure.

This valve, color coded yellow, is used during fill operations to recapture NH_3 gas from the top of the tank, as liquid fills the bottom. It is closed for all other operations.

A vapor return valve may have a [time-dated] excess flow valve.

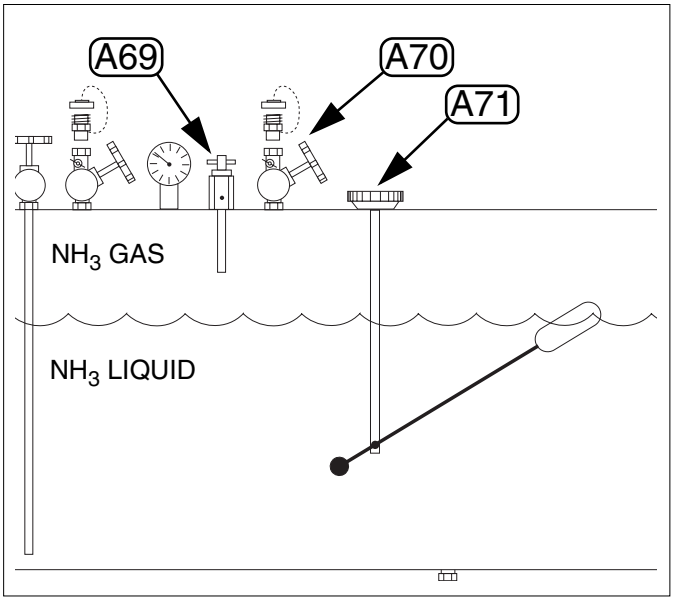


Figure 14 31574
Fixed Gauge and Vapor Valve

a. PPE: Personal Protective Equipment

Refer to Figure 15 (some components shown exploded for clarity - never remove any except the outlet cap).

A71 Liquid Level Float Gauge:

Check this gauge when accepting a tank. It needs to be in sound mechanical condition, legible, and reading no higher than 85.

This gauge has a mechanical float that is coupled to the indicator needle. Float gauges typically report 0-100 percent of fill.

Float gauges are typically mounted at tank top, facing up, but may also be installed at 45°, with face tilted up, or horizontal, with face to front or side.

On a leased tank, learn the reading to expect when the tank level reaches minimum-usable. It may be an indication above, at, or even below zero.

The gauge reading may be inaccurate if the tank is on a slope, or has just been moved (due to sloshing).

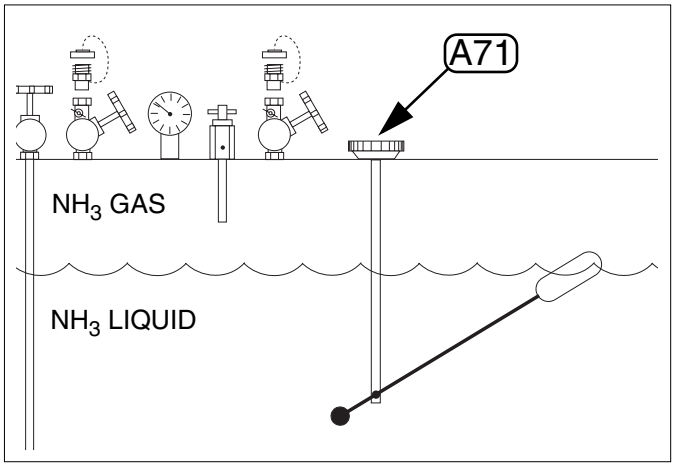


Figure 15
Float Gauge

31574

Nurse Tank Sides and Mid-Section

Refer to Figure 17 (depicting a pre-1988 ASME nameplate)

A72 Tank Nameplate:

Locate and inspect this plate. It may be anywhere on the tank (but will be on the tank, and not on the running gear or tongue). It is often at top center.

Check that the plate is present, and legible. The 1966 vintage plate depicted at right has marginal legibility in places.

Do not accept a nurse tank with an illegible nameplate. Do not accept a nurse tank that is not consistent with the requirements of anhydrous service. See ANSI K61.1/CGA G-2.1 for a complete list of requirements, but some key items to check for are:

- A72m Manufacturer name
- A72r Repair stamp - normally blank. An “R” here indicates that the tank has been repaired by an authorized facility. Do not accept a repaired tank without an “R” stamp.
- A72s Tank serial number
- A72p MWAP: Maximum Allowable Working Pressure (250 PSIG @ 125°F, is minimum and typical for NH_3 service)
- A72t Type: Must be “AG”
- A72u Official code “U”-over-”W” symbol. Any other symbol here means the tank is not NH_3 service.
- A72y Year of manufacture. A tank made before 1999 may lack current safety features.
  Do not use a tank made before July 1961.
  Do not use an undated tank.

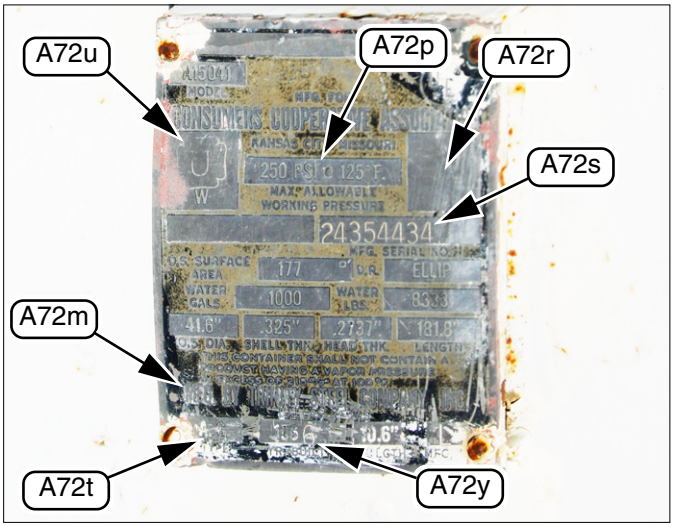


Figure 16 31562
Anhydrous Tank Nameplate

A post-1988 nameplate will also:

- be fully welded onto the tank (not riveted)
- specify the standard to which it was built, usually ANSI K61.1 or CGA G-2.1
- explicitly specify “for anhydrous ammonia use”
- specify MDMT (Minimum Design Metal Temperature)

Missing Nameplate?

If there is no nameplate, check for evidence of recertification within the last five years, such as FMCSA Cargo Tank (CT) registration number, or paper documentation under DOT SP-13554 or CSA B620.

Refer to Figure 17

A73 Safety Decals:

Study any safety decals. Make sure all operators understand them, and have learned safety procedures well enough that they know what to do without consulting the decals after an accident.

A74 Instructional Decals:

Study any operating information provided in decal form. If the nurse tank cart has no manual, informational decals may be the only formal documentation available.

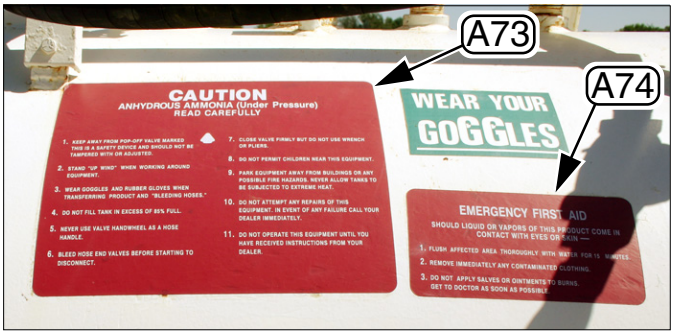


Figure 17 31563
Nurse Tank Operations Decals

Refer to Figure 18 (simulated contact information)

A75 Owner Contact Information:

Required by transport regulations, on both sides of the tank. On a leased tank, verify that the tank owner's name, address and phone numbers are present, legible and up to date.

This information may not be present or required on a tank that is operator owned.

A76 UN1005 Decal:

Same as A55 on page 11. Required by transport and hazardous materials regulations, on both sides of the tank.

A77 INHALATION HAZARD Decal:

Required by transport and hazardous materials regulations, on both sides of the tank. This decal is for all users and the general public.

A78 PPE Kit: (not shown)

A Personal Protective Equipment (PPE) kit must be supplied with each nurse tank cart. In some locales, this kit must be in a container affixed to the tank.

The kit must contain at least:

- chemical gloves
- goggles suitable for anhydrous use

If more than one person will be operating the tank in the field, obtain a second kit. See page 6 for more information on required and recommended PPE[a].

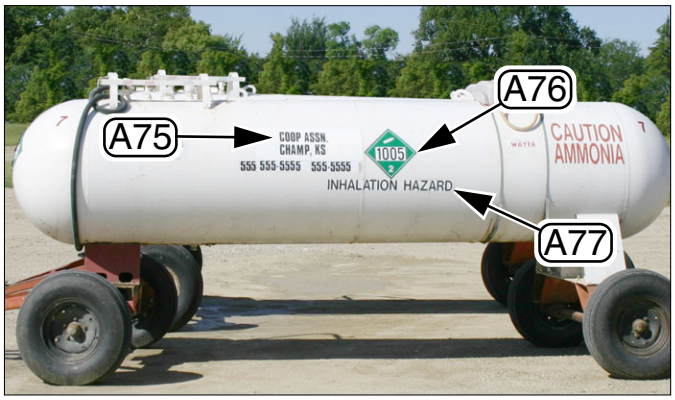


Figure 18
Nurse Tank Center
31560

a. PPE: Personal Protective Equipment

Refer to Figure 19 and Figure 20

A79 Drain Valve:

Inspect this valve (which may be merely a plug fitting). Check for general mechanical condition, and signs of criminal tampering.

Do not open this valve. It is used only to fully drain the tank for major maintenance.

A80 Relief Valve:

Locate this valve. It is on the tank top, usually under a protective structure away from the operating valves. It may be near the wash water tank.

Refilling the wash water tank often places you close to the relief valve. Be up-wind. Check the pressure gauge before refilling the wash tank.

At high tank pressures the relief valve is designed to release NH_3 until the pressure drops below 250 psi. At 120°F (40°C), the vapor pressure reaches 250 psi. Above this point, the relief valve periodically operates, and small NH_3 gas releases occur.

Refer to Figure 20

A81 First Aid Water:

Check that this tank is present.
Check that it was freshly filled.
Check that hose ends are secure.

Ensure that all operators know how the tank works. Where is it? How many hoses does it have? Do not wait until an accident to learn which end of the hose (A81a) is which.

Transport and materials safety regulations require this tank, and the decal (A81b) that identifies it. The tank may be installed on the top or side of the nurse tank.

The Nutri-Pro® implement also has a wash water tank. See "**Ammonia Emergency Action**" on page 7 for further information about First Aid Water tanks.

A82 CAUTION AMMONIA Decal:

Required by transport and hazardous materials regulations, on both sides of the tank. This decal is for all users and the general public.

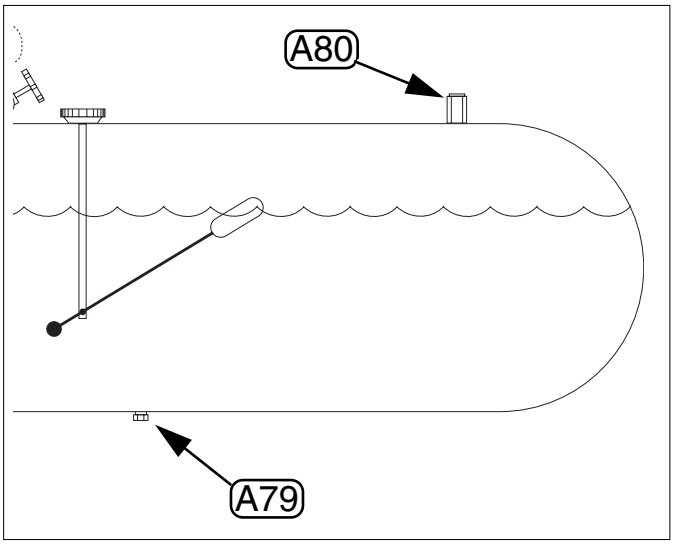


Figure 19 31574
Drain and Relief Valves

CAUTION

Ammonia Release Hazard:
On a hot day, remain up-wind of the relief valve at all times. On a hill, or if the tank is over-filled, or if the tank tips in an accident, this valve can release liquid NH_3.

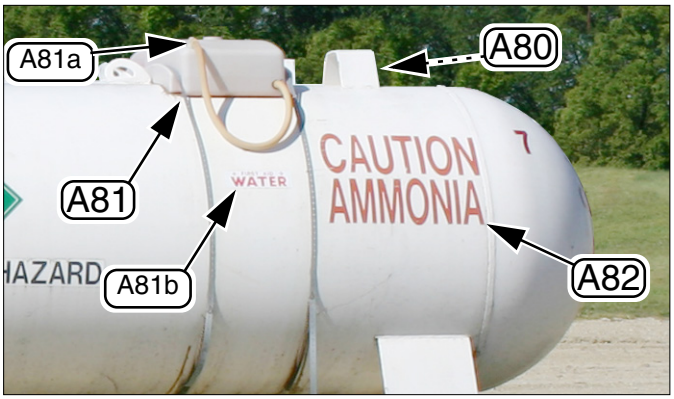


Figure 20 31560
First Aid Wash Water Tank

Nurse Tank Rear End

Refer to Figure 21

A83 Unit Number:

An emerging regulation requires a visible cart unit identification string (letters and/or numbers) on each cart in commercial service.

A84 CAUTION AMMONIA Decal:

Required by transport and hazardous materials regulations, on both sides of the tank. This decal is for all users and the general public.

A85 UN1005 Decal

Same as A55 on page 11. Required by transport and hazardous materials regulations, on both sides, and end of the tank.

A86 SMV Reflector:

Required for highway transport of any slow-moving equipment.

A87 Lights: (not shown)

Lights may be required in your jurisdiction. If transporting at night, or in daytime where daytime lights are required, test the lights before departure. Never tow an anhydrous ammonia nurse tank behind an implement on public roads.

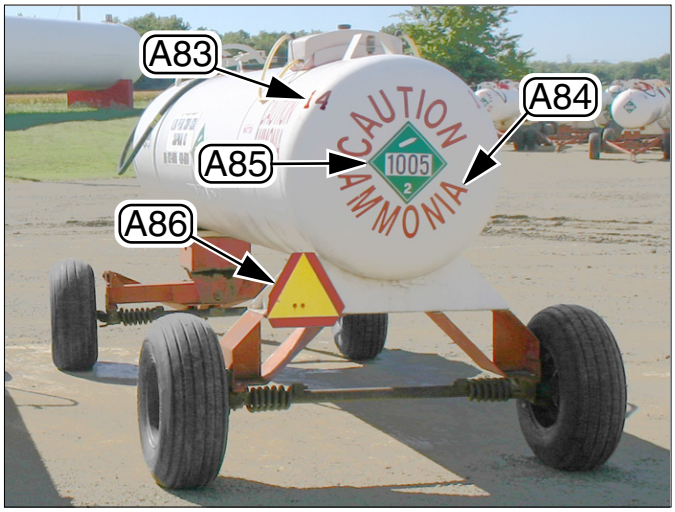


Figure 21 31561
Nurse Tank Rear End

Nurse Tank Acceptance

Use this checklist in addition to any checklists provided by the tank manufacturer, tank cart manufacturer and/or anhydrous ammonia supplier.

If no other checklist is available, print these pages to use a checklist when accepting a tank. If another checklist is available, this list may include one or more items omitted from the other lists. Check them all.

Transport the tank separately from the implement.

Consult the towing vehicle and tank operator manuals for hitching the cart to a separate towing vehicle.

Hitch the tank to the implement at the field. This topic is covered in the applicator Operator manual.

There are two pages for this checklist.

Figure 22 31673
Checklists Matter

- Do you know the wind direction? YES ❑ NO ❑
- Will you have, with you in the field, an operator manual, or manuals, for the cart, tank and all fittings and controls? (if not, see **CAUTION** on page 8). YES ❑ NO ❑
- Have the Nutri-Pro® operators studied the cart manuals? YES ❑ NO ❑
- Do you have the MSDS for the tank contents? YES ❑ NO ❑
- Are UN "**1005**" placards on at least both sides and rear of the tank (set)? YES ❑ NO ❑
- Are "**ANHYDROUS AMMONIA**" labels on at least both sides and the rear of the tank (set)? YES ❑ NO ❑
- Are "**INHALATION HAZARD**" labels on both sides of the tank (set)? YES ❑ NO ❑
- Are all safety and instructional decals present and legible? YES ❑ NO ❑
- Does the tank have a fully legible manufacturer's name plate[a] stating standards compliance? YES ❑ NO ❑
- Is the tank compliant with ANSI K61.1-1999 or CGA G-2.1-1999 or later (or other NH_3 tank standard[a] applicable in your jurisdiction)? YES ❑ NO ❑
- Is the tank filled to less than 85% full? YES ❑ NO ❑
- Does the ammonia contain at least 0.2% water? YES ❑ NO ❑
- Do you have dealer[b]/supplier contact information? YES ❑ NO ❑
- Does the tank have a visible numeric, lettered or other unique identifier? YES ❑ NO ❑
- Does the cart have a clevis hitch with 1 inch (2.5 cm) pin? YES ❑ NO ❑
- Does the cart have two safety chains? YES ❑ NO ❑
- Does each tank outlet hose have a male $1\frac{3}{4}$-4 Acme fitting and cap? YES ❑ NO ❑
- Are the hoses in good condition; free from cuts, soft spots, bulges, blistering, kinking, flattening, or indications that the hose is stretched or damaged at the coupling? YES ❑ NO ❑
- Is there at least 3 ft (92 cm) of free cart hose from the front clamp/tie, and provision to elevate the slack at least 13 in (33 cm) above the implement breakaway? YES ❑ NO ❑
- If the implement is twin-manifold or twin-pump, does the cart have twin hoses (if not twin tanks)? YES ❑ NO ❑
- Have means to secure both ends of the hose during transit to prevent damage to either hose or connections been installed? YES ❑ NO ❑
- Does the cart have rollover protection structures for all vents, valves and gauges? YES ❑ NO ❑
- Are valves, fittings and gauges rust-free and showing no signs of leaks? YES ❑ NO ❑

a. If the tank does not have a plate, or was not built to current standards, you may require a special permit for highway transport, such as DOT SP-13354 in the U.S. and CSA B620 in Canada (tanks under the former "Green Book" program must transition to B620)
b. Regulations in some locales require tank owner information to be displayed on the sides of the tank in letters at least 2 inches high.

- Is the hose outlet valve tightly closed? YES ❑ NO ❑
- Are the tank inlet and outlet valves tightly closed? YES ❑ NO ❑
- Are the liquid and vapor valves labeled or color coded? (red/orange for liquid and yellow for vapor) YES ❑ NO ❑
- Does the tank have Acme caps for vapor and liquid valves? YES ❑ NO ❑
- Are all limited-life components within their dated service lives? YES ❑ NO ❑
- Does the tank have an operating fixed liquid level float gauge? YES ❑ NO ❑
- Does the tank have an operating pressure gauge. YES ❑ NO ❑
- Is there a rust-free functional pressure relief valve, with a rain cap? YES ❑ NO ❑
- Is a clearly labelled five gallon container of fresh clean water attached to the nurse tank? YES ❑ NO ❑
- Is one pair of goggles and one pair of rubber gloves provided on the tank? YES ❑ NO ❑
- Are the tires the correct type and size for the cart, and are they all of identical type and size? YES ❑ NO ❑
- Do the cart tires have at least $^{3}/_{16}$ inch (0.5 mm) tread remaining. Do all tires have about equal tread wear? YES ❑ NO ❑
- Are the tires all free of signs of mis-alignment (uneven tread wear indicating bent axles, failing bearings, etc.)? YES ❑ NO ❑
- Are the tire sidewalls free of signs of weathering? YES ❑ NO ❑
- Are the tires inflated to specification (not to exceed the maximum pressure listed on the sidewalls). YES ❑ NO ❑
- Is the tongue of the trailer straight and in good condition? YES ❑ NO ❑
- Is the tank paint in good condition? Is it free of peeling, deep scratches, bubbles and discolored spots (which might be rust or a leak)? YES ❑ NO ❑
- Is the tank free of rust and dents, and showing no signs of cracks or leaks? YES ❑ NO ❑
- If the tank has been unattended and unsecured, is it free of any signs of tampering? YES ❑ NO ❑
- Is the cart frame free of deep rust, cracks, collision damage and other signs of possible future failure? YES ❑ NO ❑
- Does the cart appear to be in an up-to-date state of lubrication? YES ❑ NO ❑
- Are the tank and plumbing free of any signs of leaks? YES ❑ NO ❑
- Does the cart have an SMV (Slow Moving Vehicle) reflector on the rear? YES ❑ NO ❑
- Does the cart have any required trailer license plate or tags? YES ❑ NO ❑
- Do you have all required permits/licenses? YES ❑ NO ❑
- Do you have contact information for local, regional and national Emergency Response Centers? YES ❑ NO ❑
- Do you have a mobile means of summoning emergency aid, such as a cell phone? Is there adequate wireless coverage along your entire route and in the field? YES ❑ NO ❑

Anhydrous Application

Get Expert Advice

Anhydrous ammonia is 82% Nitrogen, the highest of any fertilizer. The compound NH_3 is normally a gas at ambient temperatures. It is retained in the soil only by chemical reactions and physical mechanisms, primarily reactions with soil moisture.

Consult with your agronomist about optimal application timing, rate and depth, based on proposed crop, soil temperature, soil moisture content and ambient temperature. Non-optimal applications can result in NH_3 loss to the atmosphere, soil drying, and undesired long term changes in soil pH.

Weather Extremes

Cold Weather Low Flow

DANGER

Catastrophic Release Hazard:
Do not take measures to boost pressure in cold weather. Ad hoc boosting could create risk of line rupture or tank explosion. The Great Plains system is designed for vapor pressure and gravity delivery only.

Vapor pressure changes with ambient temperature (see table at right). In colder weather, there may be insufficient pressure for higher application rates. The Raven AccuFlow™ Installation and Operation manual has a temperature-rate-speed chart.

Hot Weather Venting

WARNING

Unexpected Release Hazard:
Avoid hot weather, or be extra vigilant about remaining upwind of the tank relief valve (A80, page 21). In extremely hot weather, the tank pressure relief valve will periodically vent NH_3 when the vapor pressure exceeds 250 psi. Tank temperatures above 116°F (47°C) cause venting.

Direct sun on the tank, or parking the tank in a hot shed, could result in relief venting well below an actual ambient temperature of 116°F.

Avoid Dead Calm

The wind is your friend. Normal anhydrous ammonia operations involve small releases of NH_3 vapor. Accidents, malfunctions and serious operator errors can result in releases of *liquid* NH_3, which turns into a rapidly expanding gas cloud. You need to be "up wind" of all potential releases, and that is only possible if there is at least a breeze to carry the fumes away from you.

NH_3 Temperature and Pressure Relationship

Degrees F (C)	Pressure (psi)
-28°F (-33°C)	0 psi
0°F (-18°C)	16 psi
32°F (0°C)	48 psi
60°F (16°C)	93 psi
100°F (38°C)	197 psi
116°F (47°C)	250 psi

CAUTION

Anhydrous Ammonia Exposure Hazard:
Keep the nurse tank cool. Stay up-wind of relief valves. Check the tank pressure gauge. In hot weather, ammonia vapor releases can occur at a relief valve.

Normally, over-pressure releases occur at the nurse tank relief valve (A80, page 21). It is designed to operate at a lower pressure than other (hydrostatic) relief valves in the system. However, with operating valves closed, trapped NH_3 could activate hydrostatic relief valves anywhere in the system.

NOTICE

Lower Operating Limit:
A manifold pressure of at least 10 psi is required for the AccuFlow™ to operate correctly. If the static pressure prior to operation is not much above that, it may fall below this limit when NH_3 begins to flow.

Wash Water

Refer to Figure 23

Empty the 10 gallon implement First Aid Water tank. Refill it with fresh clean water. If the nurse tank cart is at hand, refill the nurse tank wash water as well.

The water needs to be changed daily. Water absorbs ammonia (NH_3) vapor from the air, and becomes an ammonium hydroxide (NH_4OH) solution over time.

When emptying wash tanks, use the time and water to train operators on tank operations, and first aid rinsing procedures.

Figure 23 31599
First Aid Water Station

Field Operation Safety

If field requirements permit, you can minimize exposure to NH_3 vapor with the following recommendations:

Refer to Figure 24

- Check the wind direction.
- Plan passes to be cross-wind and turns up-wind.
- Plan first pass on down-wind side of field.
- Choose your first pass to allow you to be up-wind while operating valves at the nurse tank and implement. Opening the emergency shut-off valve typically requires climbing on the implement from the right. Starting with the wind from the right is optimal.

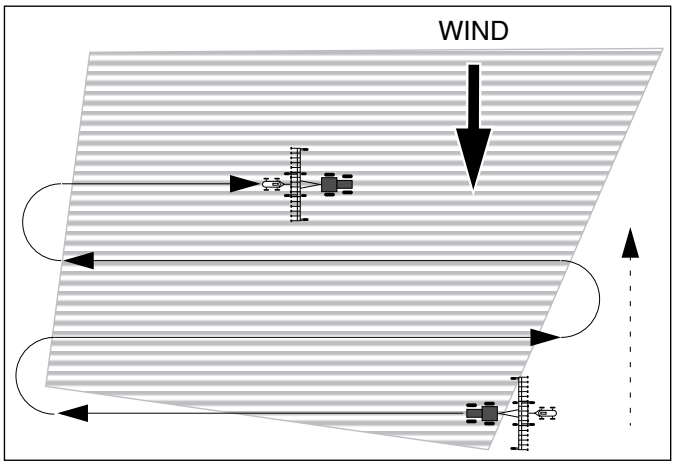


Figure 24
Ideal Pass Planning

⚠ CAUTION

Anhydrous Ammonia Exposure Hazard:
If field requirements result in any down-wind operations:

▲ *Use a tractor with a fully enclosed cab. A tractor that is not fully enclosed exposes the operator to substantially more NH_3 vapor, particularly if field requirements result in downwind turns or downwind passes.*

▲ *Have an escape route (up-wind turn) available for all down-wind operations.*

▲ *Conduct end-of-pass operations to minimize above-ground releases.*

▲ *Be mindful of the risks of olfactory fatigue. You can "get used to" the odor and fail to notice when concentrations get dangerously high.*

⚠ CAUTION

Anhydrous Ammonia Exposure Hazard:
Repeated exposure to NH_3 vapor may exceed PEL (Permissible Exposure Limits) and also may induce olfactory fatigue (adaptation). Over time, you become less sensitive to ammonia odor, and may fail to recognize dangerously high concentrations.

Dry Run

Before activating the NH_3 delivery, cautious practice is to make one dry run pass, including a turn in each direction. This assures that tine or knife depth is set correctly, hydraulics are working correctly, the nurse tank cart is tracking without issue, proper slack exists for all hoses and harnesses, and the meter console is reporting correct field speed.

Row Implement Adjustments

Make all applicator adjustments before charging the metering system with anhydrous ammonia:

- application depth
- coulter depth
- sealer adjustments

Sealer Adjustment

⚠ CAUTION

Ammonia Exposure Hazard:
Fine tune adjustments with dry runs prior to initial application. Making adjustments after beginning application, even with tines or knives left in the ground, could cause your exposure to exceed PEL, leading to health problems or injury.

If you need to make adjustments after application begins, discharge the system, and then lower the tines or knives into the ground. Minimize your vapor exposure.

Start of Pass Planning

Ideally, you want NH_3 to begin flowing out of the tines or knives right at the start of a pass, with the tines or knives already in the ground. This minimizes atmospheric releases.

Depending on wind direction, tractor capability, available headlands, and field conditions, there are several ways to start each pass.

A. **Capable Tractor:**
Lower implement into ground at start of pass. Pull forward to set them to operating depth. Start meter flow. Do not start moving until flow divider pressure gauge nears typical operating value.

B. **Headlands Available, Any Tractor:**
Lower implement to ground some distance ahead of the application area. Move forward slowly. As tines or knives enter ground, start meter flow.

C. **No Headlands, Marginal Tractor:**
Lower implement to ground at start of pass. Start forward movement, then meter flow. Move slowly until console rate display nears target rate.

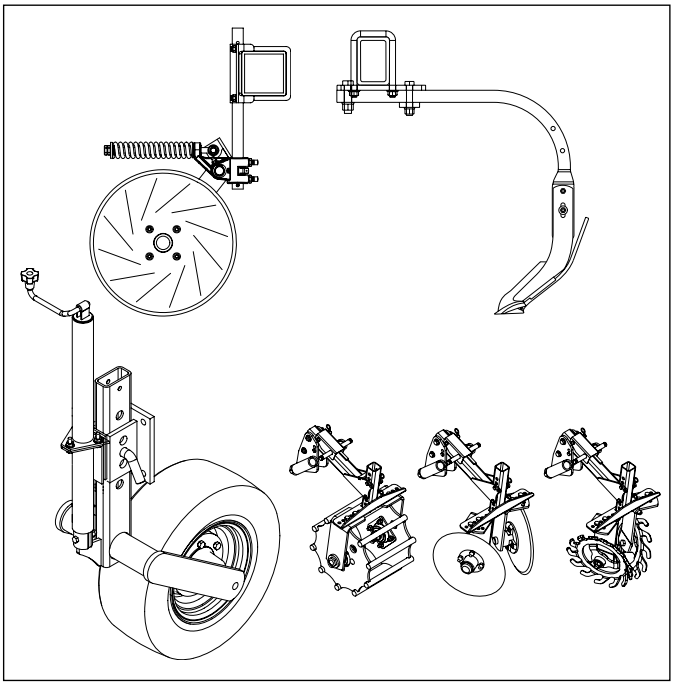


Figure 25
Adjustments

23200,
31593/7
31723

Note: The procedures at left are not operating instructions or checklists. They are outlines for planning pass starts. See the step details in the applicator Operator manual.

⚠ CAUTION

Anhydrous Ammonia Exposure Hazard:
When raising in field, be facing into the wind or be turning up-wind. Even if NH_3 flow was stopped some distance before the lift point, the tines or knives will still be emitting NH_3 vapor when out of the ground.

Starting Application

DANGER

NH_3: Possible Chemical Hazard:
Anhydrous ammonia is now flowing into the ground. Some routinely escapes to the atmosphere. Check for leaks. Take action if strong odor is detected or a leak seen. Turn up wind. Turn off flow. Check gauges from tractor cab. Engage emergency shut-off valve if a leak is detected.

Minor odor during application is normal, particularly if the tractor cab is ever down wind of recent passes.

Strong or irritating odor indicates a problem. Conditions may not be suitable for application (soil too dry, cloddy and deeply cracked, for example), or there may be a system problem.

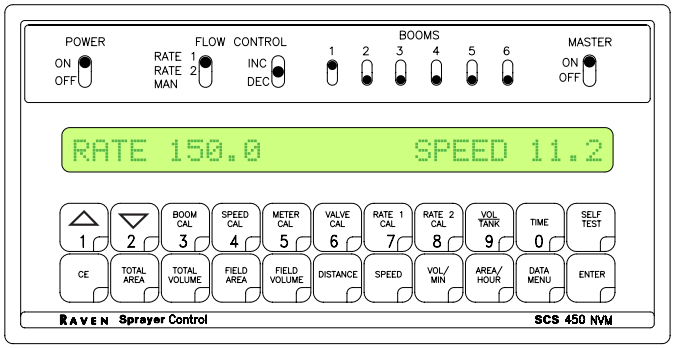


Figure 26
Typical Application Screen
31585

Field Turns

a. Before the turn,
set the MASTER switch OFF.
Leave the implement in the ground, and continue forward movement.

b. Lift the implement at the turn point.

DANGER

Major Spill / Equipment Damage Hazards:
Do not turn too tightly. The nurse tank could strike the implement, be upset, and leak. On 2-Point and Pull-Type applicators, the nurse tank tongue could strike the caster tires. On 3-Point applicators, the nurse tank tires could strike sealers, tine or knife shanks.

c. Turn up-wind for the next pass.

d. Line up per your start of pass plan.

e. Lower the implement into the ground.

f. Set the BOOMS 1 switch ON.

g. Pull forward and complete the pass.

WARNING

Ammonia Vapor Release Occurs at Turns:
Avoid down-wind turns.
Do not raise for turns if unprotected individuals or sensitive livestock are immediately down-wind of the turn. Stop instead.

Turning off NH_3 flow prior to raising for turns does deplete some of the liquid ammonia in the applicator lines, but not all of it, and considerable vapor remains. At turns, there will be some release of NH_3 vapor, and possibly some NH_3 liquid. Be prepared for it. Minimize exposure to yourself and others.

Turn up-wind immediately if a hazardous concentration of fumes reaches the tractor cab.

Stopping Application

Plan your stops. A safe stop requires depleting the anhydrous, from the nurse tank withdrawal valve to the tines or knives.

a. What is the wind direction?

b. Suspend application per "**Suspending Application**", below.

c. Put on your chemical gloves.
Be wearing your goggles.

d. Carefully approach the nurse tank from up-wind. Expect some ammonia odor, but if it is extremely strong, there may be an above-ground release in progress due to malfunction or part failure. If so, remain clear until the release subsides.

e. When safe to do so, shut off the nurse tank withdrawal valve A66 (page 16).

f. Re-enter the tractor cab.

g. Turn MASTER switch ON.

h. Resume field application until reported rate begins to fall. Increase rate to maximum (to fully open Control Valve).

i. Continue field application until both cooler and divider pressure gauges read zero.

j. Facing into the wind, raise the implement and stop.

k. Set the MASTER switch to OFF.

l. Wait at least 1 minute for row line vapor to dissipate.

m. Turn so that the wind is directly from the right.

⚠ WARNING

Ball Valves: Trapped NH_3 Hazard:
Avoid routinely closing ball valves (other than the nurse tank withdrawal valve) with liquid NH_3 in the lines. Fluid is trapped in the line above the valve, may trigger relief valves, and can get trapped inside the valve ball unless it has a bleed port (not yet common on nurse tank hoses). ***See "Avoid Line Traps" on page 37*** *and "**Avoid Ball Traps**" on page 38.*

A typical ball valve can trap enough NH_3 to make a room the size of a two-car garage uninhabitable (concentrations above IDLH in moments). When the ball valve is later opened, while warm, the NH_3 is expelled at high pressure. If the line is pointed at your face, you could receive a fatal exposure.

n. Open all bleed valves. Standing up-wind of each, and making sure orifices point away from you, slowly open bleed valves at:
- nurse tank hose inlet end A61a (page 13)
- nurse tank hose outlet end A61a (page 13)
- breakaway bleed valve A13 or A16 (page 42) (whichever is safer)
- cooler temperature gauge A27 (page 42).

o. Close all remaining operating valves:
- nurse tank hose inlet end A61a (page 13)
- nurse tank hose outlet end A61a (page 13)
- emergency shut-off valve A18 (page 42).

p. Wait at least one hour before moving implement to any spot near unprotected people or livestock. It will continue to out-gas ammonia vapor for some time.

Suspending Application

These instructions are for brief stops in the field, for example, to make a phone call. See also "**Stopping Application**" on page 29.

a. What is the wind direction?

b. Turn MASTER switch OFF.
This turns On/Off Valve off.

With On/Off Valve off, *there is still a substantial amount of liquid NH_3 downstream of all valves,* in the flow divider, row application tubing, and row applicators. When stopped, in ground, this slowly warms, vaporizes, and is expelled into the soil. See warning at right.

c. Continue field application until the Flow Divider pressure gauge reads zero. Wait at least another 5 minutes.

d. Turn up-wind.

e. Leave the implement in the ground. There is still considerable NH_3 vapor in the lines that are open to the soil. There may also be a modest amount of liquid in cold tubing loops.

⚠ WARNING

Choking Hazard:

Never raise a recently operated implement when you are down-wind of the implement. Be or turn up-wind if it is necessary to raise a working implement. Wear your goggles. A substantial amount of anhydrous ammonia is rapidly released if you do not allow time for it to bleed off underground. The concentration could be high enough to cause irritation, breathing difficulty or asphyxiation.

Unhitching Nurse Tank

The procedure is different for exchanging tanks vs. concluding application.

Exchanging Nurse Tanks

Consult with the nurse tank supplier, and all nurse tank documents, before unhitching or exchanging tanks.

a. Suspend NH_3 application per "**Suspending Application**" on page 30.

   The purpose of this step is minimize atmospheric NH_3 vapor while working at the rear hitch, because you may not be able to conduct all unhitching and re-hitching steps from up-wind of all the tines or knives.

b. Position the implement cross-wind, with the wind from the right, tines or knives in ground.

c. Use the rope to close the emergency shut-off valve (A18) (page 42).

d. Put on your goggle and rubber gloves.

e. Shut off the nurse tank withdrawal valve (A66) (page 16). Leave the nurse tank hose valves ((A61) (page 13), if any), open.

f. From up-wind, and with the orifice facing away from you, slowly open the breakaway coupler inlet bleed valve (A13) (page 42).

g. Stand clear and wait for the hoses to discharge.

h. From the up-wind side, unscrew the nurse tank hose outlet coupler (A58) (page 11).

i. Secure the nurse tank outlet coupler.

j. Close all opened bleed valves.

k. Release the nurse tank safety chains.

l. Remove the nurse tank hitch pin.

Folding and Unfolding

⚠ WARNING

Loop Ammonia Exposure Hazard:
Allow no one down-wind of the implement when folding and unfolding. Applicator tubing loops may contain liquid NH_3 that can drain out of tines or knives during wing movement. This liquid can remain in the loops long after application has ended.

After parking overnight or longer, any liquid present may be highly caustic ammonium hydroxide (concentrated NH_4OH, a solution of NH_3 and atmospheric moisture) rather than pure NH_3. Assume any liquid in loops is extremely hazardous. Take full NH_3 field precautions.

⚠ CAUTION

Control Variation Hazard:
If you are using multiple nurse tanks, study each one separately. Unless they are owned by you, and known to be identical, there is a high probability that there are differences between them, even if they are all from the same terminal.

Final Nurse Tank Unhitch

a. Conclude NH_3 application per "**Stopping Application**" on page 29.

   The purpose of this step is minimize atmospheric NH_3 vapor while working at the rear hitch, because you may not be able to conduct all unhitching steps from up-wind of all the tines or knives.

f. From the up-wind side, unscrew the nurse tank hose outlet coupler (A58) (page 11).

g. Secure the outlet coupler with the nurse tank's Acme parking plug.

h. Close all opened bleed valves.

i. Release the nurse tank safety chains.

j. Remove the nurse tank hitch pin.

k. Remove nurse tank from behind implement.

Figure 27 31617
Applicator Loops

General Safety Rules

▲ *Keep children, untrained personnel and unprotected persons well away from equipment that uses anhydrous ammonia. Children may not recognize or correctly react to the smell of ammonia.*

▲ *Have required documents.*

▲ *Inspect all equipment carefully prior to operations. Applicator and nurse tank hardware must meet strict regulatory requirements and be in excellent working order. Components must be within their expiration dates.*

▲ *Make sure all wash water tanks are full with fresh, clean unfrozen water. Change water daily.*

▲ *Perform all required maintenance. Components with specific limited service lives must be periodically replaced.*

▲ *Turn off all hose end and shutoff valves prior to transport.*

▲ *Check applicator tines or knives. In more challenging conditions, tines or knives may wear prematurely, causing stops for cleaning and unplugging, increasing low-level exposure to anhydrous ammonia.*

▲ *Have an extra set of safety equipment in the tractor cab. Have readily available communications to summon professional aid in case of accident or release.*

▲ *Park the tank in outdoor shade on hot days and warm sunny days. Never park near ignition sources. Do not smoke.*

▲ *On hot days and warm sunny days, do not stand down-wind of the nurse tank. Even if the air temperature is below 116 °F (46.7 °C), parts of the tank may be above 116 °F, raising the tank pressure to above 250 psig, and causing the relief valve to vent NH_3 gas until the pressure falls.*

▲ *Use hitch safety pins. Use safety chains.*

▲ *Follow operating instructions precisely.*
Use checklists.
Do not skip steps.

▲ *Close valve firmly, but do not wrench.*

▲ *Never allow a hose, tube, pipe end or vent opening to point at your face or body.*

▲ *Never use control valves as handles for moving hoses or climbing equipment.*

▲ *Route the emergency shutoff cord to the tractor cab prior to field operations.*

▲ *Expect small NH_3 releases during connection, disconnection, when raising the implement out of the ground and after completion of application. Stand up-wind.*

▲ *Keep the implement down wind of unprotected persons, livestock and open water after application.*

- Have documents required by law, liability carrier rules and entity policy.
- Have MSDS (Material Safety Data Sheet) and supplier documents for the anhydrous ammonia.
- Have any manuals for the nurse tank.
- Have the applicator Operator manual.
- Have the ammonia meter operator manual (such as the 016-0159-403 Raven AccuFlow™ Operator manual).
- Have the coupler operator manual (such as the FVC062 Squibb-Taylor Flo-Max manual).

▲ *Do not have unsealed containers of food or drink near the tank, implement or in the tractor. Any released NH_3 will combine with the water in the food or beverage.*

▲ *Do not move the implement indoors unless completely discharged of ammonia, or the indoor area has two openings (one up-wind), and reliable cross-ventilation.*

▲ *Always assume that, once used, NH_3 residues are present in implement hoses, tubes and metering system.*

▲ *Use only CDS-JohnBlue, Great Plains, Raven and Squibb-Taylor specified parts to repair implement components originally supplied by Great Plains. Many common plumbing materials are incompatible with NH_3. Joint compounds must be specified as ammonia-resistant.*

▲ *Never mix anhydrous ammonia with other chemical liquids. Reactions with many common materials can be violent and/or produce highly toxic by-products.*

▲ *If a fire threatens an anhydrous ammonia tank, evacuate the area. The tank may heat up faster than the relief valve can vent the rising pressure, resulting in a catastrophic gas release and possibly an explosion.*

Breakaway Event

Initially treat a breakaway coupler separation event as you would any other field emergency. Perform the steps at "**Ammonia Emergency Action**" on page 7. Only then consider performing the steps on this page.

Although the breakaway coupler is designed to separate, such *breakaways are not routine events*.

Upon a breakaway, what to do about the breakaway coupler itself is the last consideration. Priorities are:

1. Protect: Perform basic field emergency action, which may included summoning emergency responders if a major release is in progress, or the nurse tank is tipped over, or is otherwise at risk of a major release.
2. Assess: If the nurse tank appears intact, sound and stable, determine the cause of the breakaway. It is unlikely to be something simple that will allow a timely re-coupling and resumption of application.

If, and only if, the nurse tank is safe to approach, take the next steps to discharge both sides of the breakaway.

Discharge Implement:

3. Perform the steps at "**Stopping Application**" on page 29. Remain up wind and clear of nurse tank while doing this.
4. With the orifice pointing away from you, and down-wind, slowly open the coupler bleed valve A16 (page 42) at the implement half of the breakaway coupler. If you closed the emergency shutoff after breakaway, each bleed will release liquid NH_3, under pressure, *most likely as a spray*.

Discharge Nurse Tank Hose:

5. Position the tractor and implement near the nurse tank. Stop up-wind of the tank, but slightly cross-wind of the tank (so that you are not exposed to residual implement fumes while working around the tank). Face the tractor into the wind.
6. From up-wind, approach the nurse tank.
7. Close the nurse tank withdrawal valve A66 (page 16).
8. From up-wind, approach the nurse tank hose outlet end A58 (page 11).
9. Locate a bleed valve A13 (page 42) on the nurse tank half of a coupler. Be careful not to touch or loosen the Acme coupler A58 (page 11). Bleed only one hose at a time.
10. Position the outlet such that the bleed valve orifice points both away from you AND points down-wind AND can be opened and left pointing that way unattended. If this is not possible, get expert help.

DANGER

Upon Event: Probable Chemical Hazard:
A 60 cc liquid release to air has already occurred. Assume a major release is also in progress or imminent. Act accordingly. Request assistance from trained experts rather than risk blindness, disfiguring/disabling injury or death.

A breakaway event is most likely due to a major equipment failure (such as nurse tank running gear fracture), or a gross operator error (such as towing/turning too fast, or departing level ground). These cases can result in an immediate serious spill, or result in a damaged tank at risk of leak at any time.

Even in the case of a basic operator error, such as movement with only the nurse tank hose connected, both implement systems and nurse tank hose at breakaway are fully charged with liquid NH_3, right up to the checks in the breakaway halves. The nurse tank side is under full tank pressurization. The implement hose may be under pressure.

This was an unplanned event. Wind direction may not be favorable for discharging and re-coupling. ***If the wind is light or calm, do not attempt to bleed the breakaway coupler halves.*** *Your field PPE[a] is not sufficient for the releases necessary.*

a. PPE: Personal Protective Equipment

11. Opening this bleed valve WILL release the substantial amount of liquid NH_3 presently trapped in the hose, *most likely as a spray*. Open the valve very slowly, just until some fluid appears. Leave the valve just slightly open.
12. Walk away, up-wind. Stay away until the release concludes. Carefully open bleed valve completely to confirm hose is discharged. For dual-cooler, repeat step 9 through step 12 for the other hose.
13. Close all breakaway bleed valves (A13 and A16 {page 42}), and any nurse tank hose valves A61 (page 13). Disconnect the nurse tank half of the breakaway coupler at the Acme coupler A58 (page 11).
14. Correct the cause of breakaway, only if trivial to do in the field.
15. Consult the breakaway manual for re-coupling instructions.

DANGER

Before Re-connection: Elevated Exposure Hazard: *Exercise extreme care. Even if the nurse tank is undamaged, sound and upright, a breakaway event is not a normal re-hitch situation. A substantial NH_3 bleed is required that* ***WILL release a flow of liquid anhydrous ammonia under pressure. If the wind is calm or light, do not attempt to bleed the nurse tank hose.*** *Your field PPE[a] is not sufficient.*

a. PPE: Personal Protective Equipment

Ammonia Maintenance Safety

Over half of NH_3 accidents result from equipment failure. These accidents can be prevented with responsible stewardship and maintenance.

With most agricultural equipment, using substandard parts or deferring maintenance until a part fails, merely costs needless lost time and money.

With NH_3 equipment,
using unapproved parts,
deferring maintenance, or
operating components past end-of-life,
***could cost lives**.*

DANGER

Suffocation, Blinding, Burning, Freezing, Disabling and Disfigurement Hazards:
Do not perform maintenance with anhydrous ammonia in the system. Fully discharge the system of NH_3 liquid and vapor before working on the implement. See page 39.

- ▲ *Use only equipment that conforms to applicable regulations, safety standards and manufacturer recommendations.*
- ▲ *Inspect equipment carefully and thoroughly prior to every use.*
- ▲ *Discharge implement of NH_3 residues before performing maintenance. Assume any liquid in tubing loops is extremely hazardous. If not pure NH_3, it is likely to be highly concentrated ammonium hydroxide (NH_4OH).*
- ▲ *Maintain equipment as instructed:*
  Follow all safety guidelines.
  Use only approved replacement components.
- ▲ *Replace components as they reach their dated life spans.*

Incompatible Cleaners

- ▲ *Unless the implement is free of all ammonia residues, avoid cleaning the implement with products containing halogen compounds (most commonly chlorine, such as bleach) or strong oxidizers (such as any "oxi…" products. NH_3 can react violently with oxidizers and halogens, and can produce toxic gases and/or explosive compounds.*

DANGER

Trapped Anhydrous Hazard:
Never service fittings without certain knowledge that the lines and valves are fully discharged.

Implement systems can trap liquid NH_3 between closed valves, and inside closed valves (even when the lines on both sides of the valve are discharged). This NH_3 would then be released, under pressure, when a fitting is cracked, or a valve opened, days, weeks, or months after last field operations.

If an unvented ball valve had been closed on a full line, that liquid would be released under pressure and vaporize in seconds. It can contain enough liquid NH_3 to render a space the size of a two-car garage uninhabitable (NH_3 concentration at IDLH within moments).

If either end of the valve is pointed at or near your face, local concentration would dramatically higher. The outcome could be blinding, disfiguring, disabling or fatal.

Incompatible Materials

NH_3 is corrosive to:

aluminum (non-anodized)	*brass*
bronze	*cadmium*
calcium	*cast iron*
copper	*gold*
lithium	*magnesium*
mercury	*silver*
zinc	

alloys containing these metals, as well as galvanized surfaces.
Repairs with incompatible parts are likely to soon result in malfunctions and a serious accident. Brass parts can fail rapidly, from the inside out. Compounds formed with other metals may be unstable or even explosive.

Use a Mirror

Refer to Figure 27

CAUTION

Blinding, Choking and Respiratory Hazard:
Never look directly into an ammonia hose or fitting.
*Use a mirror. Always assume that ammonia is present in the system. There are many ways it can hide, and surprise you later. See "**Avoid Trapped Anhydrous**" on page 37.*

Use a hand mirror to inspect hose ends, piping ends, gaskets, vents and orifices.

Figure 27 31565
Inspecting Fitting With Mirror

About Bleed Valves:

Assume there is concentrated NH_3 at any bleed valve, unless you are completely certain which segment of a line is serviced by that bleed valve, and that the line segment has been open to the atmosphere for some time.

When installed on operating valves, it is not always immediately obvious what the bleed valve protects. On globe valves, a bleed valve near center-line might be for venting upstream or downstream. On older ball valves, a bleed valve near center-line might be for either side, or even venting the ball cavity itself.

Refer to Figure 28

The purpose of a bleed valve is to perform a controlled release, via an orifice ①, of any fluid or gas trapped in a *closed line* prior to operating other valves or uncapping at a nearby Acme fitting.

If the line is discharged, opening the valve may have no result, or may release a small amount of NH_3 vapor at low pressure. Leave the valve open at the current position. Move away up-wind. Return when the release concludes.

If the line is not discharged, opening a bleed valve may release NH_3 vapor at high pressure, or NH_3 liquid, *most likely as a spray.*

If the there is liquid in the line segment, completion of a bleed can take a long time. As the fluid turns to vapor, it chills the remaining fluid, slowing evaporation.

CAUTION

Suffocation, Blinding and Burning Hazards:
Be up-wind when operating a bleed valve.
Wear chemical gloves when operating a bleed valve.
Wear goggles when operating a bleed valve.
Do not place your body or head in front of the orifice.
Follow a check-list when operating a bleed valve.
Open a bleed valve slowly.
Leave it open until all fluid and vapor flow ceases.
This can take a long time.

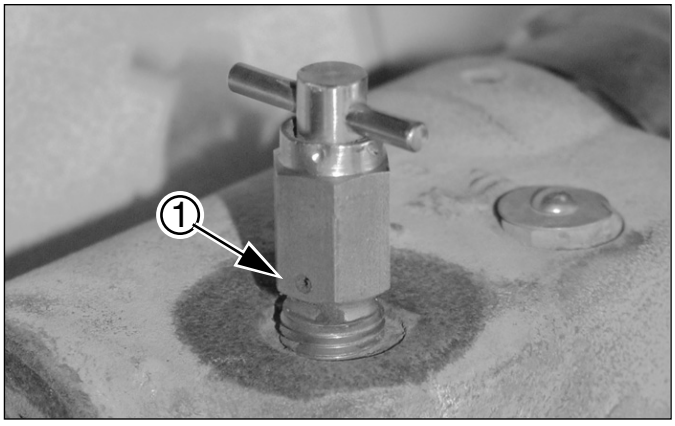


Figure 28 31569
Coupler Bleed Valve ▢ Detail

Avoid Trapped Anhydrous

Before servicing anhydrous equipment, or storing it near untrained individuals, be absolutely certain that there is no liquid NH_3 trapped in the system, and no NH_3vapor present (or only trace amounts).

Follow bleeding and discharge instructions carefully. Beware of places in the systems where NH_3 can be trapped.

Avoid Line Traps

Refer to Figure 30

Any two line valves in the system, if both closed with NH_3 present, can trap that ammonia indefinitely. Line valves include:

- tank withdrawal A66 (page 16),
- nurse tank hose valve A61 (page 13),
- check valves at a disconnected breakaway,
- emergency shut-off valve,
- control valve at rate zero A30 (page 42),
- On/Off solenoid valve, and
- aftermarket section valves.

In a properly designed system, segments not open to the atmosphere are protected by hydrostatic relief valves, but the operation of such valves only releases a small portion of the trapped ammonia.

Normal shut-down instructions, after closing the tank withdrawal valve, are intended to bleed most of the system NH_3 into the soil. However, there can still be substantial vapor in the system after that. And if shut-down procedures were not followed (or the state of the equipment is unknown at time of servicing), you need to assume that a closed valve represents a risk of trapped NH_3.

The illustration at right depicts a nurse tank hose A59 (page 12) in use, and shut-off while still full of liquid NH_3. If this hose is removed to an enclosed space, then opened, it represents an extreme hazard. Vapor concentrations could rise to well above IDLH levels in moments.

This example system line segment is equipped with relief orifice-equipped ball valves A61 (page 13), but that only bleeds the downstream side of a valve ball, the outlet valve in this example. See page 38 for information about ball traps.

The downstream side of this system line segment is equipped with a bleed valve A62 (page 13). The upstream side of the inlet valve is equipped with a hydrostatic relief valve A63 (page 14).

If this line segment warms, pressure can rise high enough to cause periodic releases at the relief valve. This protects the segment from rupture, but does not clear the line.

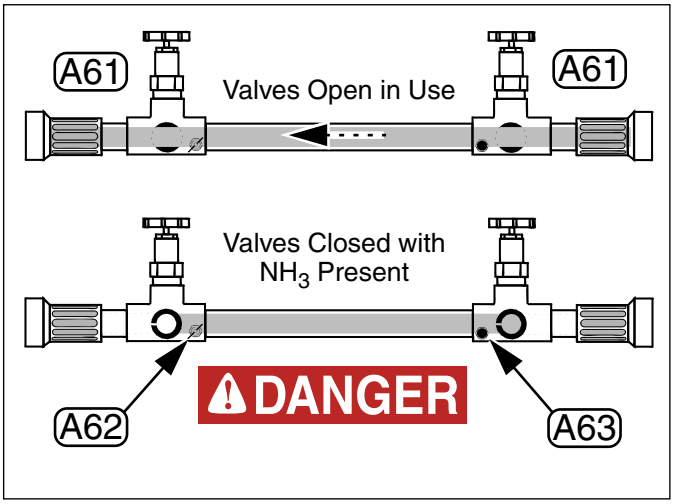


Figure 29
NH_3 Trapped in Line

31616

Clearing a Line Trap

To clear a line segment with possible trapped NH_3:

- ▲ *Move the equipment outdoors.*
- ▲ *If calm, wait for wind.*
- ▲ *Stand up-wind of the bleed valve.*
- ▲ *Point the bleed valve orifice down-wind and away from all personnel.*
- ▲ *If it's a hose bleed valve, make sure you can set the hose down with the valve still pointing in a safe direction.*
- ▲ *Open the valve very slowly. Once any discharge is observed, (set any hose down) depart up-wind.*
- ▲ *Remain up-wind until the discharge completes.*

Avoid Ball Traps

DANGER

IDLH Anhydrous Ammonia Exposure Hazard:
Beware of closed ball valves. A ball valve can trap liquid NH_3. If opened when disconnected, this liquid is likely at extreme pressures, is emitted forcefully and vaporizes rapidly. A $1^3/_4$in ball valve can trap enough NH_3 to reach IDLH vapor concentrations, within moments, in a space the size of a two car garage. Anyone present could be burned, blinded, or receive serious or permanent lung injury. If this happens in an enclosed space, the consequences could be fatal.

Refer to Figure 30
Always assume a closed ball valve contains liquid NH_3 under high pressure.

The flow gate of a traditional ball valve is a solid steel ball with a hole through it. When closed, the hole cavity is sealed by the side walls of the valve body.

If closed with the line full, the ball cavity is full of NH_3. If the valve is well constructed, that fluid remains there indefinitely, presenting future field and service hazards.

Note: If the valve has a bleed valve and/or relief valve, those safety valves *do not vent the ball cavity when a solid ball valve is closed*. One of them may vent just the downstream side of an orifice ball with the ball closed.

The emergency shut-off valve (A18) (page 42) supplied on Great Plains implements in October 2010 and later has a relief orifice on the downstream (strainer) side of the valve.

Nurse tank hoses are likely to have solid ball valves indefinitely. Treat all ball valves as potential traps.

- ▲ *Wear your PPE[a] when servicing lines and fittings that are in an uncertain status.*
- ▲ *Fully bleed all lines prior to servicing.*
- ▲ *Never carry a valve by the operating wheel or handle.*
- ▲ *Open ball valves when both sides of their lines are bled.*
- ▲ *Re-check the bleed on at least one side of the opened valve.*
- ▲ *If closing a ball valve for storage or parking, first wait for the valve to warm to ambient temperature to ensure that no liquid NH_3 remains.*
- ▲ *Never point a hose at your face.*

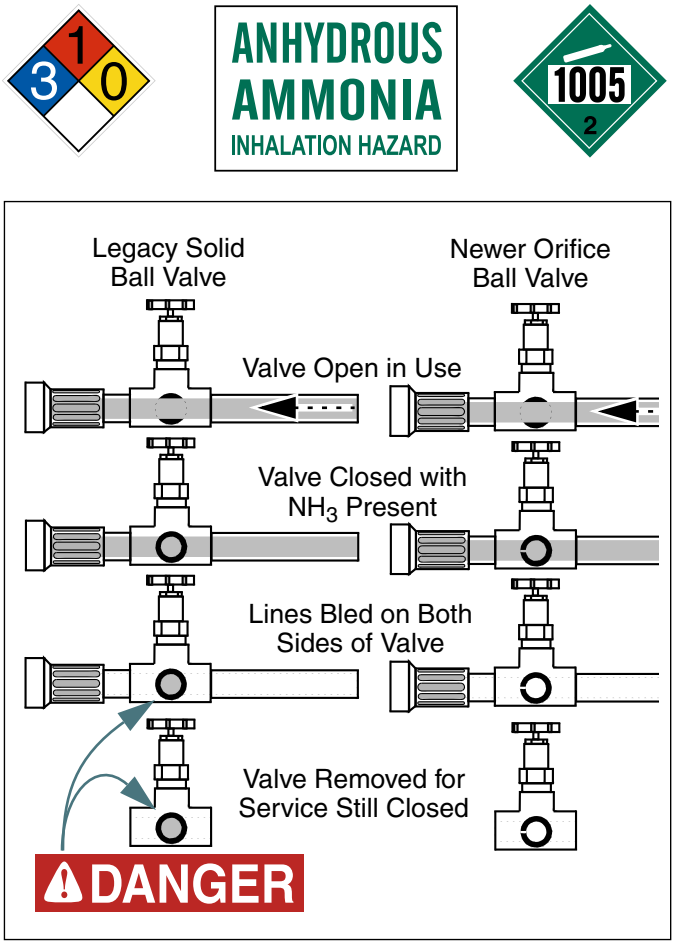


Figure 30
Legacy Valve Ball Trap
31614

- ▲ *Treat all closed valves as possible traps.*
- ▲ *Never open a closed valve in an enclosed area.*
- ▲ *Never point a closed valve at your face.*
- ▲ *If replacing a ball valve, don't just check that the new valve is specified for NH_3 service:*

  Replace orifice ball valves only with orifice ball valves.

  Replace solid ball valves with orifice ball valves.
- ▲ *Install an orifice ball valve correctly. The orifice side points down-stream (in the direction of flow).*

a. PPE: Personal Protective Equipment

System Discharge

These steps are for clearing an implement for service or for storage near untrained persons. These instructions presume that you have followed the steps at: "**Stopping Application**" on page 29, and the nurse tank is unhitched, per: "**Final Nurse Tank Unhitch**" on page 31.

For a breakaway event, follow the instructions on page 33 up through breakaway re-connection. Then perform a normal shutdown (other than nurse tank steps), per page 29.

The challenges in system discharge are:

- NH_3 liquid can remain in the system after the recommended stopping procedures.
- NH_3 liquid self-cools as it evaporates, slowing evaporation. It can take a long time for all of it to turn to vapor, particularly in cooler weather.
- Once there is only vapor in the system, there is usually little gas movement to drive the rest of it out.
- The applicator tubing loops are usually the last to clear, and may not fully clear. See sidebar.

Even if no ammonium hydroxide forms, the NH_3 vapor in the system dilutes slowly with air. Harmless trace amounts, noticed as occasional odor, may remain indefinitely.

Normal Discharge

At the completion of stopping application and nurse tank unhitching, all line valves are closed and all bleed valves are open, and have been that way for at least an hour. Transport may also have occurred, which aids clearing.

1. Verify that all line valves are closed, and all bleed valves open. If this is not the case, there is risk of trapped ammonia. See "**Clearing a Line Trap**" on page 37.
2. Carefully walk down-wind of the implement. Check for ammonia odor. If pungent, there is at least some pure NH_3 vapor in the system, and possibly some liquid. Give the implement some time to vent.

   If there is no, or only mild odor, check the applicator loops for visible fluid. If only a few hours have elapsed since application ended, *this liquid is pure NH_3*. Stay away until it has vaporized.
3. From up-wind, check all the fittings and lines. If any are cold (more than a few degrees below ambient temperature), liquid evaporation is still in progress or has only recently completed. Give the implement more time to vent.

Steps continue on next page...

DANGER

Suffocation, Blinding, Burning, Freezing, Disabling and Disfigurement Hazards:

Do not perform maintenance with anhydrous ammonia in the system. Fully discharge the system of NH_3 liquid and vapor before working on the implement.

The applicator tubes are open to the atmosphere at the tines or knives. When they don't clear immediately, they are likely to absorb atmospheric moisture, forming ammonium hydroxide (NH_4OH) in the tubes. This liquid is *highly caustic*, and can persist for weeks or months, but remains liquid at ambient temperatures, is harmless to the tubing, and emits ammonia vapor slowly. If there is liquid in the tubes, and it is not cold, it is likely to be an NH_4OH solution, and not pure NH_3.

Figure 31
Applicator Loops

31617

Hydrostatic Relief Valve Maintenance

Relief valves require scheduled replacement and periodic inspection.

Relief Valve Inspection

Inspect relief valves seasonally, and during periodic maintenance. Check for cap present (step 2) prior to each application from a fresh tank of anhydrous.

1. Bleed the line at a relief valve before a detailed inspection. See "**System Discharge**" on page 39.

Refer to Figure 32 (depicting cooler relief valve)

2. Check that the rain/dust cap is in place and fully seated.

   Do not operate with a missing cap. The cap keeps the spring mechanism, outlet (vent port) ① and weep holes ② free of contaminants that could prevent valve operation in an over-pressure situation.

   A missing or dislodged cap also indicates that the valve may have operated, or may be malfunctioning. Understand and correct the reason for a dislodged cap prior to field operations.

   Replacement caps are:
   breakaway: Continental 400-DC
   cooler: Squibb-Taylor 1325-8.

⚠ CAUTION

Ammonia Exposure and Loss Hazards:
Understand and correct the reason for any lifted or missing hydrostatic relief valve caps. If a cap is out of place, that line section may have been closed with liquid NH_3 present, which later partially vented, dislodging the cap.

Liquid NH_3 may still be present. ***Carefully bleed the line section before taking any other action.***

It is also possible that the valve disc has deteriorated, or has debris under the seat and is venting or leaking at normal operating pressures.

Any hydrostatic relief valve that fully opens ("pops") must be removed and re-tested (or simply replaced).

3. Carefully remove the dust cap.
4. Check the replace-by date ③ stamped on the valve. If it has passed, replace the valve before next use.
5. Clean any clogged weep holes ②. If they cannot be cleaned, replace the valve.

⚠ CAUTION

Ammonia Exposure Hazards:

- ▲ *Wear safety equipment when inspecting or performing maintenance on relief valves. Even if the line is bled, NH_3 liquid or vapor may still be present.*
- ▲ *Always bleed the system before removing a relief valve cap or performing any more detailed inspection or valve maintenance.*
- ▲ *Never stand in front of or look directly into a relief valve. Use a mirror. If an overpressure event or valve malfunction is imminent or in progress, you can expect multiple valve activations. The initial activation can blow debris as well as liquid ammonia into your face.*
- ▲ *Follow inspection and replacement instructions carefully. Use the instructions on these two pages only if no separate instructions were supplied with the original and/or replacement valve.*

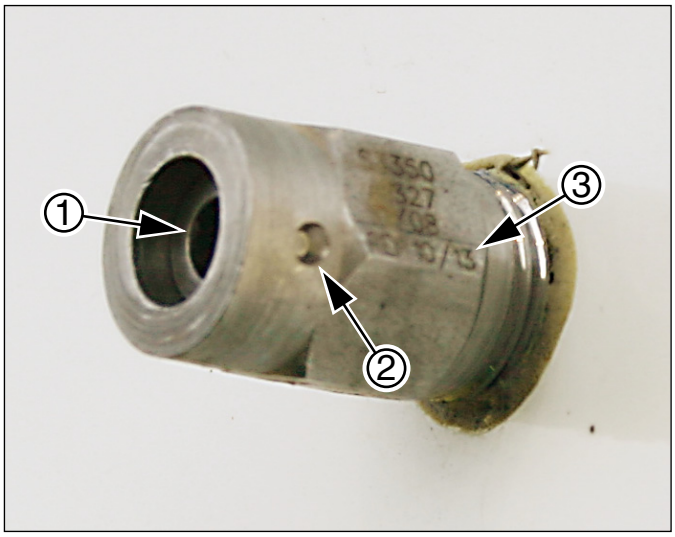


Figure 32 31635
Uncapped Relief Valve A23

Note: In severe conditions (such as exposure to salt, corrosive chemicals or pollutants), or if a valve has fully opened, you may need to replace a hydrostatic relief valve sooner than 5 years.

6. Inspect for dirt, sand, grease, paint, damage, corrosion, signs of tampering or insect activity. If visible, check the metal surface of the spring.

   If debris cannot be easily cleared, replace the valve.
   If there are signs of damage, replace the valve.
   If there is any question, replace the valve.
7. If a valve is venting at normal operating pressures, replace the valve.
8. Never force a valve closed. If a valve has remained open after operating, or is leaking, it is seriously contaminated or failed. Replace the valve.
9. Never attempt to protect a valve orifice with grease. Grease can harden over time, and/or collect contaminants. Either factor could prevent valve operation in an overpressure situation.

   Never plug a relief valve outlet. Relief valves are economical defense against serious ruptures and major releases. Help a valve do its job of protecting you.

Valve Replacement

The safest source for a replacement valve is Great Plains. Check the latest edition of the Parts manual (page 1) or the Great Plains internet parts lookup. This assures a correct and compatible part that reflects any engineering enhancements.

⚠ CAUTION

Ammonia Exposure Hazard:
Fully discharge the system (page 39) before removing an old valve. Wear protective equipment. If the implement was recently used, or ammonia was trapped, there could still be NH_3 liquid or vapor behind the valve.

Do not attempt to repair or adjust a relief valve. Hydrostatic relief valves are factory-set and tested, on specialized equipment, to discharge at a specific pressure.

On the component being protected by the valve, inspect the threaded hole after removing the valve. If there are signs of corrosion, replace the entire component.

Use pipe sealant when installing a replacement valve. Use only pipe sealant specified for use with anhydrous ammonia, such as RectorSeal No. 5. Do not use tape.

Record the replace-by date of the new valve in the "**Replacement Log**" section of the applicator Operator manual.

⚠ CAUTION

Ammonia Exposure and Rupture Hazards:
Always replace a relief valve with a valve:

- ▲ *that is an external "hydrostatic relief valve",*
- ▲ *that is specified for anhydrous ammonia service,*
- ▲ *that has the same NPT pipe thread size, and;*
- ▲ *that is rated for the same discharge pressure as the valve removed (or as otherwise specified by Great Plains or the manufacturer of the protected component).*

  Discharge pressure is specific to the valve location in the system.

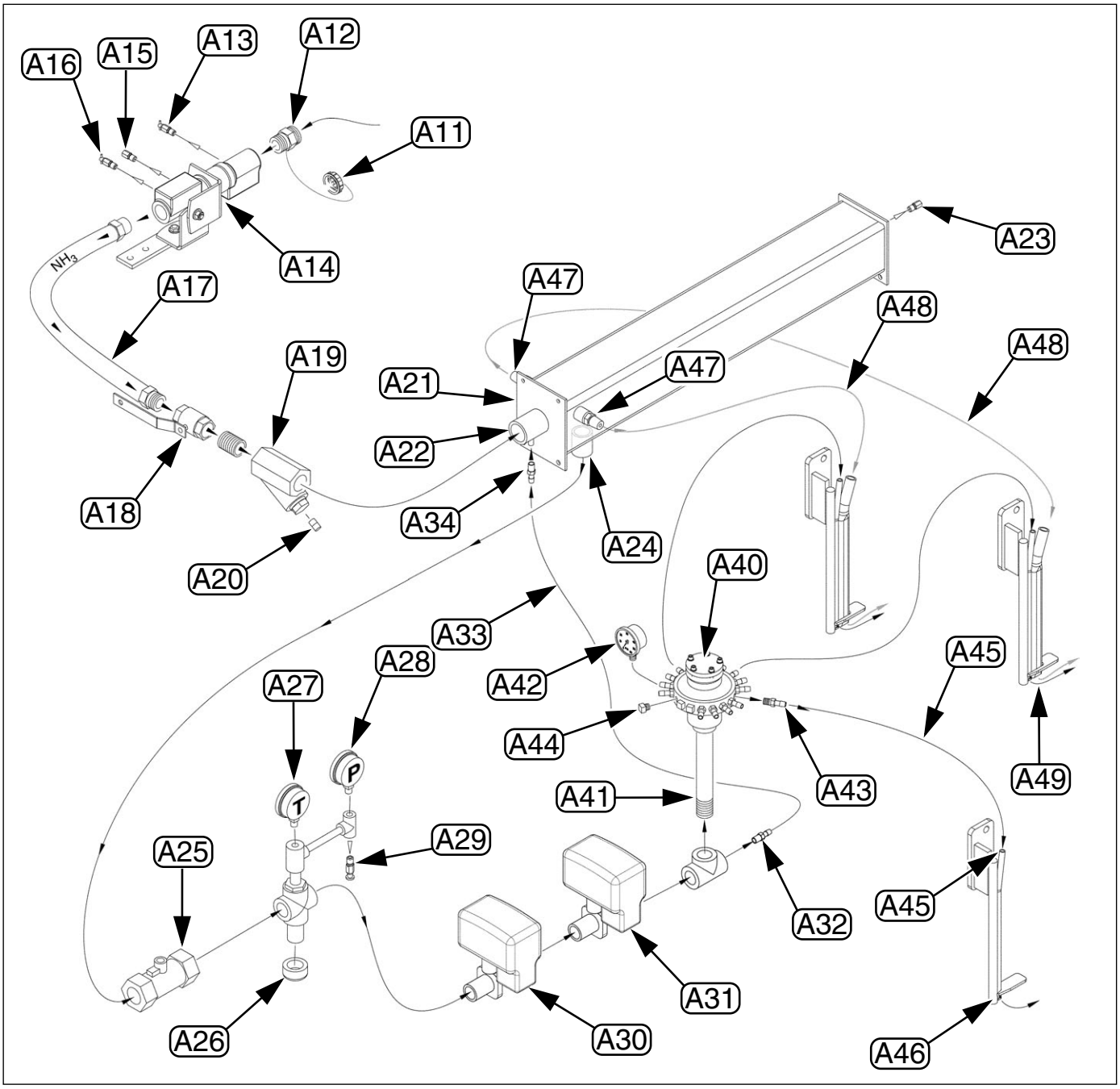
  Using a valve rated too high could result in bursting of system components and a major liquid NH_3 release.

  Using a valve rated too low could result in unexpected liquid NH_3 release, and material loss during application.

Appendix

Single-Cooler NH_3 Plumbing

See applicator Operator manual for legends, dual-cooler and section control diagrams.



34960

Figure 33
Plumbing - Single Cooler Single Section System

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